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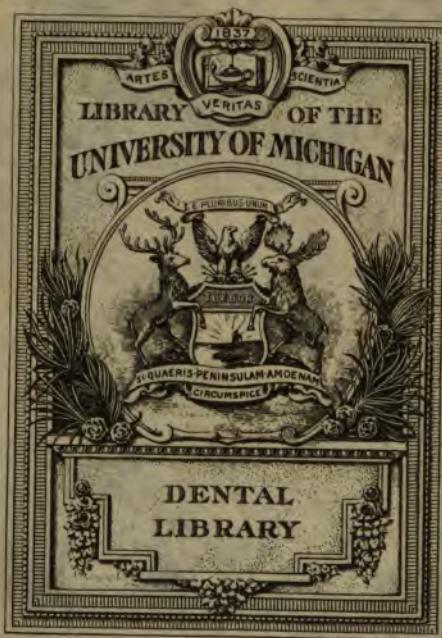
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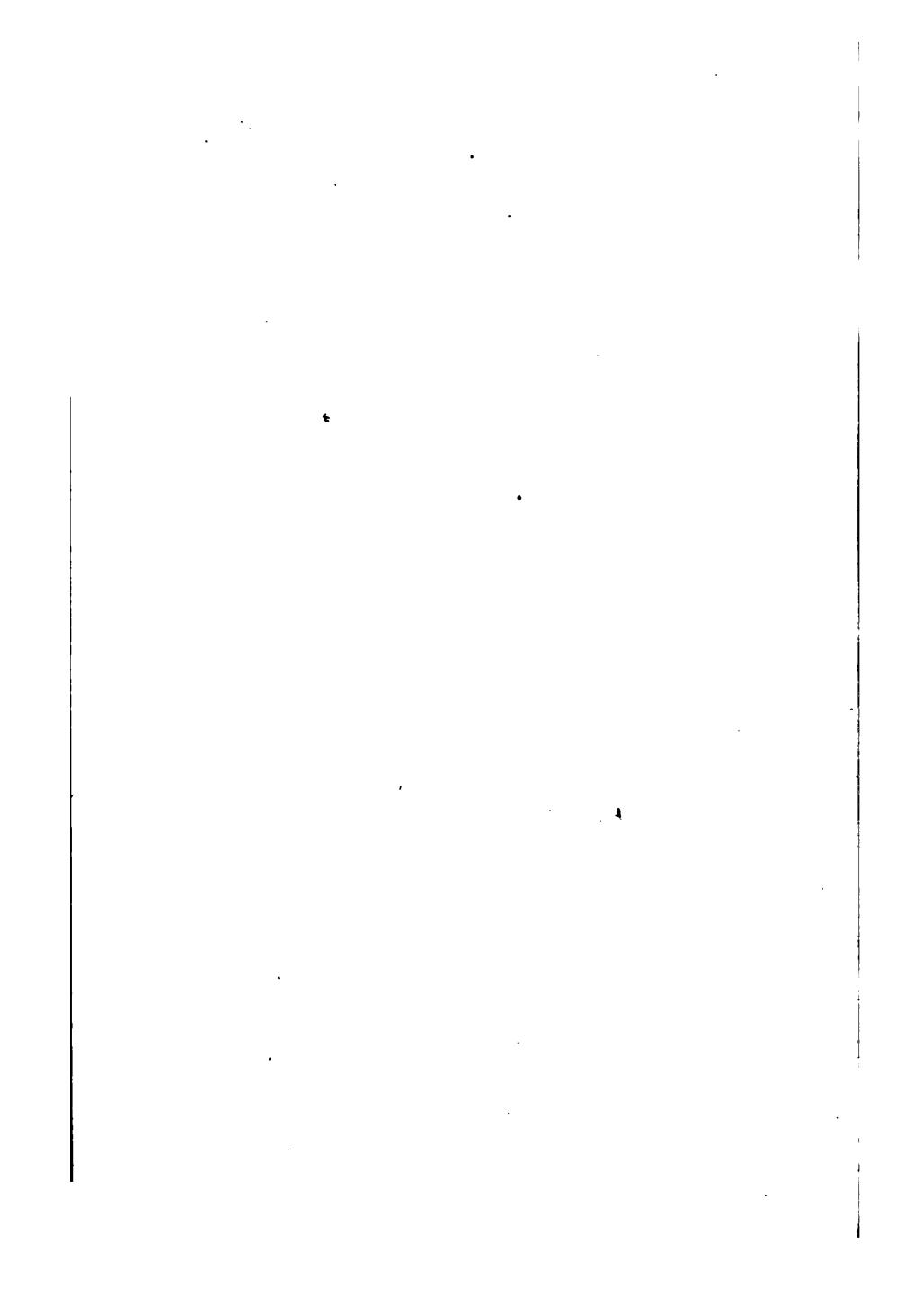
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SERIES OF QUESTIONS  
FOR THE  
DENTAL STUDENT.  
GOR GAS.

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# SERIES OF QUESTIONS PERTAINING TO THE CURRICULUM

OF THE

## DENTAL STUDENT:

EMBRACING DENTAL HISTOLOGY, DENTAL PATHOLOGY, DENTAL SURGERY,  
DENTAL PROSTHESIS, DENTAL MATERIA MEDICA AND THERAPEUTICS,  
ANATOMY, PHYSIOLOGY, CHEMISTRY AND METALLURGY.

BY

FERDINAND J. S. GORGAS, M. D., D. D. S.,

OF THE

UNIVERSITY OF MARYLAND.

BALTIMORE, MD.,  
WM. K. BOYLE & SON,  
*Corner of Baltimore and St. Paul Streets.*

1885.

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## PREFACE.

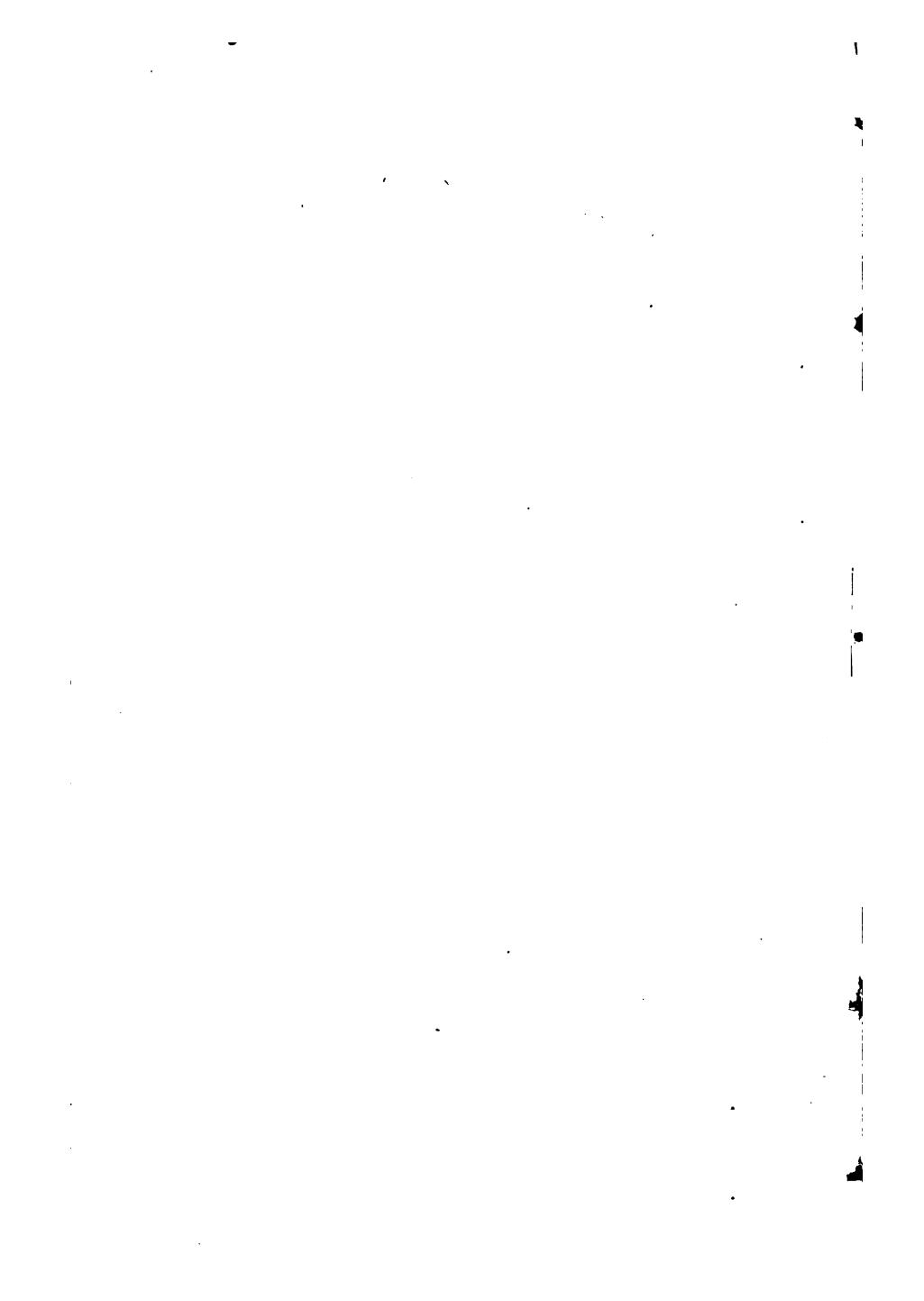
THIS work comprises leading questions on all the branches belonging to the course of study pursued by the dental student, and its object is to facilitate the study of Dental Science and its collateral sciences.

Some years ago the author published a small work embracing, in an abridged form, questions on Dental Science, and the favor with which it was received by the students of his class, for whose especial benefit it was prepared, was such as to rapidly exhaust the limited edition, and induce him to promise, when opportunity offered, a more complete series of questions embracing the entire curriculum of the dental student, and even that of the medical student so far as relates to Anatomy, Physiology and Chemistry. The preparation of the "Dental Medicine," and the extensive revision of the 11th edition of "Harris' Prin. and Pract. of Dentistry," in addition to other duties, entailed such an amount of labor, that no opportunity presented itself for the completion of this "Series of Questions" until the present time.

This work is therefore the fulfilment of the promise referred to, and is published with the hope that it may accomplish the object for which it has been prepared.

F. J. S. GORGAS.

259 HAMILTON TERRACE,  
Baltimore, Md.  
October, 1885.



## CONTENTS.

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### DENTAL HISTOLOGY.

	PAGE.
Development of the Bones of the Head and Face.....	1
Mucous Membrane, Gums, Dental Periosteum.....	2
Development of the Teeth.....	3
Dental Ridge, Dental Follicle—Enamel Organ, Dentinal Papilla, Follicular Wall, etc., etc.....	3
Enamel, Dentine, Cementum, Dental Pulp.....	4
Description of the Teeth.....	5
Dentition.....	5
Malformed and Irregular Teeth.....	8
Temperaments.....	9

### DENTAL PATHOLOGY.

Irritation.....	14
Inflammation.....	14
Pathological Conditions of the Dental Pulp.....	17
Neuralgia.....	18
Stomatitis, Gingivites.....	18
Thrush, Aphthae.....	19
Dental Periostitis.....	19
Alveolar Abscess.....	19
Dental Exostosis.....	19
Abrasion of the Teeth.....	20
Denudation of the Teeth.....	20
Necrosis of the Teeth.....	20
Atrophy of the Teeth.....	20
Necrosis of Alveolar Processes.....	20
Alveolar Pyorrhœa.....	20
Hypertrophy of Alveolar Processes.....	21
Absorption of Alveolar Processes.....	21
Hemorrhage.....	21
Salivary Calculus.....	21
Dental Caries.....	21

### DENTAL SURGERY.

Irregularity in the Arrangement of the Teeth.....	24
Treatment of Dental Caries.....	24
Filling Teeth.....	24

Capping Exposed Pulps.....	25
Filling Pulp Canals.....	25
Extraction of Teeth .....	25
Replantation and Transplantation of Teeth.....	25
Ankylosis of Jaws.....	25
Dislocation and Fracture of the Jaw.....	25
Abscess of Antrum.....	25
Tumors of the Mouth and Jaws.....	26
Dentigerous Cysts, Ranula, Polypus, Hare-Lip.....	26
Staphylorrhaphy, Cleft, Palate.....	26
Deformities of the Hard and Soft Palates.....	26
Electro-Magnetic Mallet, Electric Mouth Lamp, Dental Engine.....	27

#### DENTAL PROSTHESIS.

Preparation of the Mouth for Artificial Dentures.....	27
Impression Materials, Appliances and Methods.....	29
Casts or Models, Dies and Counter-Dies.....	31
Swaging, etc.....	33
Clasps, Articulation, Adjustment of Teeth, Lining or Backing and Soldering.....	34
Vacuum Cavities.....	36
Vulcanite Work.....	36
Celluloid and Zylonite.....	39
Metallo-Plastic Work.....	41
Pivot and Bridge Work.....	41
Obturators and Artificial Palates.....	42

#### DENTAL MATERIA MEDICA AND THERAPEUTICS.

Definition of Terms.....	43
Influence of Age, Sex Temperament, etc., etc. in Modifying Effects of Medicinal Substances.....	43
Characteristic Indications of the Tongue.....	44
Weights, Measures, etc.....	44
Rules for Regulating Doses.....	44
Pulse, Respiration, Thermometers, etc.....	44
Classification of Medicinal Agents.....	44
Forms of Medicinal Substances.....	46
Medicinal Substances, Properties, Uses, etc.....	46
Anaesthetics.....	52

#### ANATOMY.

Bones.....	53
Muscles and Fasciae.....	58

Arteries, Veins.....	59
Absorbents.....	60
Nerves.....	61
Heart, Lungs, Larynx, Trachea.....	62
Organs of Voice and Respiration.....	63
Urinary Organs.....	63
Organs of Digestion.....	63
Organs of the Senses.....	65

#### PHYSIOLOGY.

Composition of the Body.....	66
Food.....	67
Digestion.....	67
Absorption.....	69
Blood Circulation.....	70
Respiration.....	72
The Voice.....	73
Temperature.....	74
Secretion and Excretion.....	74
The Nervous System.....	76
The Special Senses.....	77

#### CHEMISTRY.

The Chemical Division of Substances.....	78
Definition of base, salt, acid, alkali, alkaloid, etc., etc.....	78
Chemical Equations.....	79
Atomic and Molecular Weights, Atom, etc.....	79

#### INORGANIC CHEMISTRY.

Oxygen and Hydrogen.....	79
Chemical Calculations.....	80
Water.....	80
Nitrogen, The Atmosphere.....	81
Nitric Acid and Oxides of Nitrogen and Ammonia.....	81
Carbon.....	82
Chlorine.....	84
Bromine .....	85
Iodine, Fluorine, Sulphur.....	86
Selenium, Tellurium, Silicon, Boron.....	87
Phosphorus, Arsenic.....	88
Chemical Properties of Metals.....	89
Metals of the Alkalies.....	89
Spectrum Analysis.....	92

## ORGANIC CHEMISTRY.

Organic Analysis, . . . . .	93
Cyanogen, Carbonyl and Sulpho-Carbonyl Compounds and Paraffin Group . . . . .	94
Monatomic Alcohol Group . . . . .	94
Dicarbon or Ethyl Series, and Higher Carbon Series . . . . .	95
Compounds of Alcoholic Radicals with Nitrogen Group of Elements . . . . .	95
Compounds from the Alcohols by Oxidation . . . . .	96
Distomic Alcohols . . . . .	96
Trivalent Alcohols and Derivatives . . . . .	97
Carbo-Hydrates, Sugars and Glucose . . . . .	97
Starch, Gum, Glucocides, Group of Aromatic Compounds . . . . .	98
Turpentine and Camphor—Vegeto-Alkaloids . . . . .	99
Albuminous Substances . . . . .	100
Animal Chemistry . . . . .	100

## METALLURGY.

Elements and their Divisions . . . . .	102
Noble and Base Metals . . . . .	103
Properties of Metals . . . . .	108
Alloys . . . . .	104
Amalgams . . . . .	106
Melting Metals . . . . .	109
Combination of Metals with Non-Metallic Elements . . . . .	109

## METALS EMPLOYED IN DENTAL PRACTICE.

Gold . . . . .	110
Silver . . . . .	114
Platinum . . . . .	115
Tin . . . . .	117
Lead . . . . .	119
Zinc . . . . .	120
Bismuth . . . . .	122
Antimony . . . . .	122
Mercury . . . . .	123
Palladium . . . . .	125
Iridium . . . . .	126
Aluminium . . . . .	127
Cadmium . . . . .	129
Copper . . . . .	130
Iron, Steel . . . . .	131
Electro-Metallurgy . . . . .	133

## DENTAL HISTOLOGY.

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### DEVELOPMENT OF THE BONES OF THE HEAD, AND FACE, AND THE TEETH.

1. What is the first definite form which is developed in the embryo?
2. What is the chorda dorsalis?
3. What is the embryonal cranium developed from?
4. From what do the four pharyngeal arches proceed?
5. Where is the buccal depression situated?
6. Into what two parts does the first pharyngeal arch divide?
7. What do the inferior maxillary protuberances, after uniting, form?
8. What are developed from the nasal process?
9. What is Meckel's cartilage?
10. What time does it first appear?
11. What is its function? and when does it disappear?
12. At what period of embryonal life are slight traces of ossification observed in the development of the lower jaw?
13. At what period of gestation is the rudimentary jaw bone formed?
14. Does the period of evolution in the upper jaw correspond with that of the lower jaw?

15. Of how many bones is the upper jaw composed during its development in early foetal life?
16. What are the intermaxillary bones or premaxilla?
17. What teeth are developed in the two intermaxillary bones?
18. What teeth are developed in the two maxillary bones before union takes place with the intermaxillary?
19. When do the intermaxillary and maxillary bones unite, so as to reduce the number to two instead of four?
20. What covers the interior cavity of the mouth, the palate, pharynx and lips?
21. Beginning at the margin of the upper and lower lips, trace the lining membrane of the mouth?
22. What membrane is directly concerned in the development of the teeth?
23. Of how many layers is the membrane lining the mouth composed, and what are their names?
24. What does the epithelium correspond to?
25. Of how many layers does it consist?
26. Describe the different layers?
27. What is the basement membrane?
28. What is the corium or proper mucous membrane, and of what two layers does it consist?
29. What is the submucous areolar tissue?
30. What is the gum composed of? describe the gum?
31. Describe the dental periosteum?
32. What blood-vessels and nerves supply the gum?
33. What blood-vessels and nerves supply the dental periosteum?

34. At what period does the development of the teeth commence?
35. What is the condition of the jaws of the embryo when the formation of the teeth begins?
36. From what are the principal structures of the teeth derived?
37. What is the dental ridge?
38. Describe the dental follicle?
39. From what is the enamel developed?
40. Describe the enamel organ?
41. Describe the dentinal germ or papilla?
42. Describe the evolutions of the enamel organ, dentinal papilla and follicular wall?
43. Describe the changes which occur in the epithelial cord?
44. What does the expanded extremity of this cord form?
45. What are odontoblasts?
46. What are ameloblasts or prismatic cells?
47. What are the stellate cells of the enamel?
48. What is the membrana praeformativa?
49. What is the dental cuticle or Nasmyth's membrane?
50. Describe the development of the dentinal papilla?
51. What causes the rupture of the epithelial cord?
52. What are given off from the remains of this cord?
53. When does the formation of the secondary follicle of the permanent tooth begin?
54. What becomes of epithelial proliferations or buddings of the epithelial cord after its rupture? at what point is it severed?

55. Describe the origin of the cementum ?
56. Describe the origin of the permanent teeth ?
57. What direction does the epithelial cord of the permanent tooth take, and what form does it assume ?
58. Describe the course of the permanent dental follicle, and its relation with the primitive follicle ?
59. The origin of the cords of the temporary or deciduous teeth ?
60. The origin of the cords of the twenty anterior permanent teeth ?
61. The origin of the cords of the permanent molar teeth ?
62. Between what periods are the follicles of the temporary teeth developed ?
63. Between what periods are the follicles of the permanent teeth developed ?
64. Does the epithelial cord determine the form, function and place of genesis of the corresponding tooth ?
65. Is the formation of supernumerary teeth supposed to depend upon the proliferations or buddings of the remains of the epithelial cords ?
66. Describe the origin, composition, form and function of the dental pulp ?
67. Describe the changes it undergoes from its formation to advanced age ?
68. Describe the structure, composition and functions of the enamel ?
69. Describe the structure, composition and function of the dentine ?
70. Describe the structure, composition and function of the cementum ?
71. Describe the dental periosteum ? its functions ?

72. In what respects do the temporary teeth differ from the permanent teeth?
73. Give the number and names of the temporary and permanent teeth?
74. Describe the permanent teeth and their arrangement?
75. How is a tooth anatomically divided?
76. By what different names are the teeth designated?
77. What classes of teeth in the temporary set?
78. What classes of teeth in the permanent set?
79. What are the relations of the cusps of the upper and lower molars to each other?
80. What are the relations of the cutting edges of the front teeth of the upper and lower jaws to each other?
81. Describe the connection of the teeth with their alveolar cavities?
82. By what names are the different surfaces and angles of the crowns of the teeth designated?

#### DENTITION.

1. What does the term dentition imply, and of how many stages does the process consist?
2. When does the process of first dentition begin?
3. Describe the process of eruption of the temporary teeth?
4. Name the order and periods of the eruption of the temporary teeth?
5. Do the teeth of the upper or the teeth of the lower jaw generally appear first?
6. Is premature or retarded eruption most common?

1\*

7. What are the causes of retarded eruption ?
8. What is a Normal Dentition ?
9. What is an Abnormal Dentition ? Describe the symptoms ?
10. The period at which the derangements of Dentition may occur ?
11. Name the Diseases incident to First Dentition ?
12. What effect has the condition of the system upon dentition ?
13. What is the immediate cause of the irritation of an erupting tooth ?
14. What constitutional symptoms may result from such irritation ?
15. Describe the symptoms of infantile convulsions ?
16. Describe the treatment of convulsions ?
17. Necessity and Proper time for Lancing the Gums, and Contra-indications ?
18. Describe the manner of performing this operation ?
19. Describe the treatment of diarrhoea occurring during the period of first dentition ?
20. Describe the treatment of skin affections attending dentition ?
21. How may Artificial Lime Salts prove beneficial during Gestation and Lactation ?
22. What affections of the oral mucous membrane may occur during difficult dentition ?
23. Name the period at which First Dentition is completed ?
24. What is the average age at which a child begins to shed the Temporary Teeth ?
25. What changes occur in the Bones and Muscles of the Face at childhood ?

26. What is the condition of the Temporary Teeth when the eruption of the Permanent Teeth begins ?
27. What are the effects of the Premature Eruption of the Temporary Teeth ?
28. What is the condition of the Permanent Teeth when the Temporary Teeth are fully formed ?
29. What is the cause of the destruction of the Roots of the Temporary Teeth ?
30. What changes occur in the Alveolar Process when the eruption of the Permanent Teeth occurs ?
31. Why does little irritation attend the eruption of the Permanent Teeth except the 3d Molars ?
32. What constitutional disturbance may occasionally attend the eruption of the Permanent Molars ?
33. Name the preventive measures against caries in the Temporary Teeth ?
34. Up to what age is it necessary to preserve the Temporary Teeth ?
35. What effect has Alveolar Abscess of Temporary Teeth upon their Permanent successors ?
36. What is the necessity for the Preservation of the Temporary Canines ?
37. What is the necessity for the Preservation of the Permanent Canines in the treatment of Irregularity ?
38. Under what circumstances would you extract a 1st Permanent Molar ?
39. At what period of life may the extraction of a 1st Permanent Molar do the least harm ?
40. What is meant by a Third Dentition ?
41. At what age, nature of the Teeth, and theory as to the development of Teeth of 3d Dentition ?

42. Describe the treatment in the case of an erupting third molar, causing great local and constitutional disturbance?

43. How early in life should the Correction of Irregularity of the Teeth be commenced?

44. Name the common Causes of Irregularity of the Teeth and the common forms?

45. Name the general rules in regard to the Construction of appliances for correcting Irregularity?

46. In the treatment of Irregularity what must we take into consideration?

47. What is the condition of the Teeth, Mucous Membrane, Palate and Lips as associated with Mental Defect?

48. What is the proper course for the Mother to pursue during Gestation and Lactation in order to insure a perfect denture in the child?

49. What preparations are employed to supply an insufficiency of Lime Salts?

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## MALFORMED AND IRREGULAR TEETH.

1. Are deviations of the deciduous teeth in form, size and number as common as those of the permanent teeth?

2. Are deviation from normal size and shape of Teeth more common to roots or to crowns?

3. To what teeth is an abnormal shape most common?

4. To what teeth is an irregular position most common?
5. What are Supernumerary Teeth?
6. What are Supplemental Teeth?
7. What are Geminous Teeth?
8. What are Nodular Teeth?
9. What are Odontomes?
10. What is an Osseous Union of Teeth due to, and varieties?
11. What are Attached Teeth?
12. Describe Syphilitic Teeth?
13. Describe the condition of tooth tissues known as Dilaceration?
14. What is meant by the operation called Torsion?
15. What is meant by Replantation of Teeth?
16. What is meant by Transplantation of Teeth?
17. To what is the stability of Replanted Teeth due?
18. To what is the stability of dried Transplanted Teeth due?
19. What are Atrophied Teeth?
20. What are Exostosed Teeth?

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## TEMPERAMENTS.

1. What does the word 'Temperament' imply?
2. Characteristics of the Sanguine Temperament?
3. " " Bilious Temperament?
4. " " Lymphatic Temperament?
5. " " Nervous Temperament?

6. What are combined or mixed Temperaments ?
7. Describe the relation of Temperament to the Teeth ?
8. Describe the Physical Indications of the different classes of Teeth ?

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## DENTAL PATHOLOGY.

1. What does General Pathology comprehend ?
2. Define Special Pathology ?
3. Define Medical or Internal Pathology ?
4. Define Surgical or External Pathology ?
5. Define Dental Pathology ?
6. Define Pathological Anatomy ?
7. What constitutes Disease ?
8. Define the term Lesion ?
9. Name the most common diseases of Bone ?
10. What effect does the intimate union of the earthly and animal matters have upon the preservation of Bone .
11. Name the Diseases common to the Periosteum ?
12. What effect does the preservation of the under portion or layer of the Periosteum have in the re-production of Bone ?
13. Name the diseases to which the Mucous Membrane of the Mouth is subject ?
14. What are the Gums remarkable for when in a normal condition ? What, when in an abnormal condition ?
15. Name the diseases peculiar to the Gums ?

16. A hot, swollen and tender condition of the Gums in an infant depends upon what?
17. A red line upon the edge of Gums, which are a little spongy and tender, with a slight fetor of breath and a metallic taste, indicates what cause?
18. A blue line upon the edge of Gums, is characteristic of what?
19. A general spongy condition of the Gums with sloughing and great fetor indicates the presence of what disease?
20. Under what circumstances do Salivary and Sanguinary Calculi produce the same effects upon the Gums?
21. What does a red line about the neck of a tooth, and on the margin of the Gums indicate?
22. What does a dark purple and swollen condition of the Gums, with an offensive, purulent discharge often indicate?
23. What does a hot, red, swollen and very tense condition of Gums indicate?
24. When the Gums become soft, and fluctuation can be perceived, what condition is present?
25. What does an elastic fluctuating swelling in any part of the face, or for some distance down the neck indicate?
26. What does a feeling of uneasiness in a tooth with a disposition to grind the teeth together indicate?
27. What does a fistulous opening in the Gum over the root of a tooth indicate?
28. What does the expansion of jaw bone at some particular spot with disfigurement, and a sense of weight and tension, indicate?

29. What does a hard, bony tumor on the alveolar ridge, and in form corresponding to a tooth, indicate?
30. When the Gums become thickened, tumid and of a deep red color, and pus oozes from margins, which separate from alveolus, and one or more teeth loosen and fall out, and the pain resembles periostitis, what do such symptoms indicate?
31. What does a gradually increasing prominence of the cheek, which more or less involves the mouth, at length closing the nostril, and causing double vision, denote?
32. What denotes a malignant form of tumor in either jaw?
33. What constitutes Cleft Palate?
34. What constitutes Hare Lip?
35. What does a widely opened mouth with inability to close it, the chin prominent, and a distinct hollow in front of each ear, denote?
36. What does a mouth partially open, and the chin displaced to one side, and a hollow below one ear, denote?
37. What may a chronic inability to open the mouth, depend upon?
38. What does distortion of the face, in which the mouth is drawn to one side, denote?
39. What does more or less obstruction of one or both nostrils, with occasional watery discharge, denote?
40. What form of ulcers on the mucous membrane may decayed and fractured teeth cause?
41. To what special diseases are ulcers of the mouth often due?

42. When ulceration of the mouth is obstinate under any but specific treatment, to what may it be due?
43. What are the symptoms of syphilitic inflammation of the mouth?
44. What does a white coated tongue denote?
45. What does a brown, moist tongue denote?
46. What does a brown, dry tongue denote?
47. What does a red, moist tongue denote?
48. What does a red, dry tongue denote?
49. What does a red, glazed tongue denote?
50. What does a tremulous, moist and flabby tongue denote?
51. What appearance of tongue denotes tertiary syphilis?
52. What is an Epulis?
53. What is a Fibrous Tumor?
54. What is a Myeloid Tumor?
55. What is a Fungoid Tumor?
56. What is Epithelioma?
57. What is an Osseous Tumor?
58. What is a Vascular Tumor?
59. What is Osteo-Sarcoma?
60. What is a Cancerous Tumor?
61. What is a Cartilaginous Tumor?
62. What is a Papillary Tumor?
63. What is an Osseous Cyst?
64. What two classes of cysts are connected with the teeth?
65. What is a Dentigerous Cyst?
66. What is a Nasal Polypus?
67. Abscess of Antrum, Symptoms, Causes, Effects, and Treatment?

68. Variations of the pulse in health during Infancy, Child 5 years of age, Youth, Male adults, Female adults, Old age.

69. The effect of the temperature of the body on the pulse ?

### IRRITATION.

1. What relation does irritation bear to inflammation ?
2. What condition does irritation indicate ?
3. What is the termination of irritation, when it is permitted to exist for a length of time ?
4. Varieties of irritation ?
5. Definition of each variety ?
6. What is meant by direct irritation ?
7. What is meant by indirect irritation ?
8. In what manner is irritation generally excited ?
9. Effects of irritation on vascular system ?
10. Susceptibility to irritation according to age, sex, and temperament ?
11. Name the predisposing causes of irritation ?
12. Treatment of irritation ?

### INFLAMMATION.

1. Define Inflammation ? The predisposing and exciting causes ?
2. Symptoms of inflammation ? Describe each of these symptoms ?
3. Is the absence of one or more of the symptoms incompatible with the existence of inflammation ?
4. What is the most constant of all the symptoms of inflammation ?

5. What is the redness of an inflamed part due to ?
6. What is the heat of an inflamed part due to ?
7. What is the pain of an inflamed part due to ?
8. What is the swelling of an inflamed part due to ?
9. What are the Terminations of Inflammation ?
10. Describe the Termination in Resolution ?
11. When is it desirable to bring about resolution ?
12. What is healing by first intention ?
13. What conditions oppose such a process as healing by first intention ?
14. Describe Adhesion ?
15. How does coagulable lymph become organized ?
16. The beneficial effects of Adhesion ?
17. Liability of mucous membranes to adhesive inflammation ?
18. Injurious effects of adhesive inflammation ?

Preventive measures ?

19. What is meant by Effusion ?
20. Nature of the effused liquid ?
21. Define Oedema ?
22. Name the results of serous effusion ?
23. With what condition of blood is serous effusion often associated ?
24. Treatment of serous effusion ?
25. What is meant by Granulation ?
26. By what means is lost tissue restored ?
27. Character of Healthy and Unhealthy Granulations ?
28. What is meant by Cicatrization ?
29. In what respects does the Cicatrix differ from the original structure ?
30. Mucous, Serous, Fibrous and Salivary Structures are repaired by what kind of production ?

31. Describe the process of Suppuration ?
32. Symptoms of Suppuration ?
33. What is Hectic Fever ?
34. What organs and tissues are very prone to suppuration ?
35. What organs and tissues are not prone to suppuration ?
36. What is Pus ? Varieties of Pus ?
37. What is an Abscess ?
38. What is meant by Ulceration ?
39. Organs and Tissues prone to Ulceration ?
- Those not prone to Ulceration ?
40. Causes and Treatment of Ulceration ?
41. Describe an Ulcer ?
42. Describe Fungous, Congestive, Callous, Gangrenous Fistulous Ulcers ?
43. What is meant by Mortification ?
44. Describe the termination in Gangrene ? Varieties of Gangrene ?
45. Describe the progress of Mortification ?
46. What is the Line of Demarcation ?
47. What membranes and organs are prone to Mortification ?
48. Local and Constitutional Causes of Mortification ?
49. Constitutional symptoms of Mortification ?
50. Treatment of Inflammation ?
51. Varieties and treatment of each form of Inflammation ?
52. What does Necrosis signify ?
53. Describe the causes, diagnoses and treatment of Necrosis ?

54. What is Coagulable Lymph ? When is it beneficial, and when is it dangerous ?

55. What is meant by Hyperaemia ? Plethora ? Anaemia ?

### PATHOLOGICAL CONDITIONS OF THE DENTAL PULP.

1. Name the Diseases affecting the Dental pulp ?
2. Treatment of Irritation of Dental Pulp ?
3. Symptoms, Causes and Treatment of Ossification of the Dental Pulp ?
4. Causes and Treatment of Fungous Growth of Dental Pulp ?
5. Treatment of partially exposed Dental Pulps ?
6. Treatment of wholly exposed Dental Pulps ?
7. How diagnose Normal and Abnormal Sensibility in an exposed Dental Pulp ?
8. Treatment of a wounded Dental Pulp ?
9. Symptoms, Causes and Treatment of Acute Inflammation of the Dental Pulp ?
10. Symptoms, Causes and Treatment of Chronic Inflammation of the Dental Pulp ?
11. Reasons for devitalizing the Dental Pulp ?
12. Therapeutical and Surgical methods of devitalizing the Dental Pulp ?
13. Treatment after the removal of the Dental Pulp. Treatment of Putrescent Pulps ?
14. Why Hysteria, Dyspepsia, Rheumatism, Malaria, Phthisis Pulmonalis cause Odontalgia ?
15. What does the term Odontalgia imply ? also the treatment ?

16. Does the Temperament of the patient modify the pain of Odontalgia ?
17. What Constitutional Symptoms attend acute inflammation of the Dental Pulp ?
18. How diagnose between pulpitis and Dental Periostitis ?

#### NEURALGIA.

1. What does the term Neuralgia imply ?
2. Describe the nature of Neuralgic pain ?
3. Describe the General, Central, Local and Reflex Causes of Neuralgia ?
4. How determine when the Cause of the Neuralgic pain is due to the Teeth ?
5. Cause of Neuralgic pain in the Ear during First Dentition ?
6. Cause of Neuralgic Odontalgia during Pregnancy ?
7. Treatment of Neuralgia ?
8. What may be the cause of severe Neuralgic pain in an Alveolar Cavity sometime after the extraction of a Tooth ? What is the Treatment ?

#### STOMATITIS, GINGIVITIS.

1. What does the term Stomatitis imply ?
2. Symptoms, Causes and Treatment of Simple or Catarrhal Stomatitis ?
3. Symptoms, Causes and Treatment of Ulcerous Stomatitis ?
4. Symptoms, Causes and Treatment of Scurvy ?
5. Symptoms, Causes and Treatment of Gangrenous Stomatitis or Cancerum Oris ?

6. Symptoms, Causes and Treatment of Thrush ?
7. Symptoms, Causes and Treatment of Aphthæ ?
8. What does the term Gingivitis imply ?
9. Symptoms, Causes and Treatment of Acute and Chronic Inflammation of the Gums ?
10. Symptoms and Treatment of Mercurial Stomatitis ?
11. Causes and Treatment of Hypertrophy of Gums ?

#### DENTAL PERIOSTITIS.

1. Symptoms, Causes and Treatment of Acute and Chronic forms of Dental Periostitis ?
2. How diagnose Dental Periostitis from Dental Exostosis ?

#### ALVEOLAR ABSCESS.

1. Symptoms, Causes and Treatment of Alveolar Abscess ?
2. What are the successive steps in the Formation of Alveolar Abscess ?
3. What does the extent of an Abscess depend upon ?
4. Difference between Acute and Chronic forms of Alveolar Abscess ?
5. Location of Sac and points of escape of Pus ?
6. Abscess of Antrum, diagnosis and treatment ?

#### DENTAL EXOSTOSIS.

1. Symptoms, Causes, Diagnosis and Treatment of Dental Exostosis ?
2. How diagnose Dental Exostosis from Pulpitis or Periostitis ?

**ABRASION OF THE TEETH.**

1. Causes, Effects and Treatment ?

**DENUDATION OF THE TEETH.**

1. Causes, Effects and Treatment ?

**NECROSIS OF THE TEETH.**

1. Causes, Effects and Treatment ?
2. Describe the process of bleaching a Discolored Tooth ?

**ATROPHY OF THE TEETH.**

1. Causes, Effects and Treatment ?
2. Name the different varieties of Atrophied Teeth ?

**CARIES OF THE MAXILLARY BONES.**

1. Symptoms, Causes and Treatment ?

**NECROSIS OF ALVEOLAR PROCESSES.**

1. Symptoms, Causes and Treatment of Necrosis of Alveolar Processes ?
2. Phosphor Necrosis, Symptoms, Cause and Treatment ?

**ALVEOLAR PYORRHCEA.**

1. Symptoms and Causes ?
2. Surgical and Therapeutical Treatment ?

## HYPERTROPHY OF ALVEOLAR PROCESSES.

1. Symptoms, Causes and Treatment?

## ABSORPTION OF ALVEOLAR PROCESSES.

1. Symptoms, Causes and Treatment?

## HEMORRHAGE.

1. Alveolar Hemorrhage, Causes and Treatment?
2. What is meant by a Hemorrhagic Diathesis?
3. Difference between Capillary, Venous and Arterial Hemorrhage?
4. What does Active Hemorrhage result from?
5. What does Passive Hemorrhage result from?
6. What is the Action of Styptics in the treatment of Hemorrhage?

## SALIVARY CALCULUS.

1. What is Salivary Calculus? Origin, Varieties, Effects?
2. Name the composition and deleterious effects of Salivary Calculus?
3. Method of Removing Salivary Calculus?
4. What is Sanguinary Calculus?
5. Name the source, nature and deleterious effects of Sanguinary Calculus?

## DENTAL CAVITIES.

1. What is Dental Caries?
2. What is the difference between Caries in the Teeth and Caries in Bone?

3. Name the Predisposing Causes of Dental Caries?
4. Name the Exciting Causes of Dental Caries?
5. What influence do the micro-organisms exert in the progress of Dental Caries?
6. What acid is, perhaps, more directly concerned in the production of Dental Caries than any other?
7. Name the sources of acids coming in contact with the Teeth?
8. Describe the particular effect of the different Acids found in the Mouth upon Tooth Structures?
9. Does the destruction of the organic constituents of Dentine, precede or follow the Decalcification?
10. Is the invasion of the micro-organisms preceded or followed by the extraction of the Lime Salts?
11. The extent to which a Tooth suffers from the action of an Acid, depends upon what?
12. What kind of a process would you term Caries of the Enamel? and what does it at once result in?
13. Is the course of Caries of Cementum analogous to that of Dentine?
14. What is meant by the Septic Theory of Dental Caries?
15. Do congenital defects of Tooth structure and the form and size of the Teeth have any influence in the attacks of Dental Caries upon such structure?
16. Describe the effects of syphilis, scrofula, dyspepsia, upon the Teeth?
17. Describe the effects of tobacco, salivary and sanguinary calculi, galvanic action, pregnancy, impaired health, upon the Teeth?
18. Describe the Microscopical Appearance of Dental Caries?

19. Give the Analysis and general characteristics of Dental Caries ?
20. Describe the Difference in the Effects of Dental Caries on Enamel and Dentine ?
21. Points on the Teeth prone to attacks of Caries ?
22. Differences in the Consistency and Color of Dental Caries ?
23. Liability of the different Classes of Teeth to Caries ?
24. Pernicious Effects of Carious Teeth ?
25. The Normal Condition of Saliva and Mucus ?
26. How test the condition of the Oral Fluids ?
27. What effect does Vitality of Tissue have on the progress of Dental Caries ?
28. Upon what does the degree of sensitiveness of Dental Caries depend ?
29. What Acids may be present in vitiated Saliva ?
30. The Development and Function of Osteo or Secondary Dentine ?
31. What causes Tubular Consolidation of Dentine ?
32. Preventive Measures, hygienic, against Dental Caries ?
33. In preparing a Dentifrice, what properties should such a compound possess ?
34. How Neutralize Acid Medicines when taken into the Mouth ?
35. How correct Acidity of the Oral Fluids when such a condition is due to systemic causes ?
36. Causes and Treatment of Abnormal Sensibility of Dentine ?

## DENTAL SURGERY.

1. Describe the common forms of irregularity of arrangement of the Teeth of the upper and lower jaws ? also the Causes ?
2. Describe the treatment, both surgical and mechanical, of the common forms of irregularity of the Teeth ?
3. Give the general rules to be observed in the construction of appliances for correcting irregularity ?
4. Describe the treatment in superficial Dental Caries ? name the instruments employed ?
5. Describe the different methods of Separating Teeth ?
6. Describe the general treatment of deep-seated Dental Caries ?
7. Name the materials employed in Filling Teeth ?
8. Describe the different methods of manipulating cohesive and non-cohesive gold, and also the instruments best adapted for each form, and the process of finishing fillings of gold ?
9. Describe the application of the rubber-dam ? also of clamps ?
10. Describe the methods of manipulating plastic filling materials ? also the instruments adapted for such materials ?
11. Describe the manner of using cylinders of gold in filling Teeth ?
12. Describe the Herbst method of filling with gold ?
13. Describe the method of introducing Contour fillings ?

14. Describe the methods of capping partially and wholly exposed pulps of Teeth ?
15. Describe the methods of filling the pulp canals of Teeth, and the materials and instruments used ?
16. Indications and contra-indications for the extraction of Teeth ?
17. Describe the instruments employed in the extraction of Teeth ?
18. Describe the extraction of the different classes of Teeth ? also of roots of Teeth ?
19. Describe the extraction of malformed and partly erupted Teeth ? other difficult cases of extraction ?
20. Necessity for the use of the gum lancet in extracting Teeth ?
21. Describe the extraction of Temporary Teeth ?
22. Name the accidents incident to extraction and their treatment ?
23. Under what circumstances may paralysis of the inferior dental nerve follow extraction ? symptoms ?
24. Describe the operation of Replantation of Teeth ?
25. Describe the operation of Transplantation ?
26. Describe the treatment in a case of closure of the jaws by a Cicatrix ?
27. Describe the symptoms, and the operation of reducing Dislocation of the lower jaw ?
28. Describe the symptoms, and the treatment of fractures of the jaws ?
29. Describe the treatment in abscess of the Antrum ?

30. Describe the treatment of malignant and non-malignant Tumors of the mouth and jaws?
31. Describe the treatment of Dentigerous Cyst?
32. Describe the treatment of Ranula?
33. Describe the treatment of Polypus?
34. Describe the treatment in Hare Lip?
35. Describe the operation of Staphyloraphy?
36. Describe the treatment in Syphilitic Cleft Palate?
37. How diagnose and treat a tumor of the Antrum?
38. Why is the lower jaw more liable to necrosis than the upper jaw?
39. Treatment of necrosis of the Maxilla?
40. Describe the operation for Tongue-tie?
41. What is the treatment in ulcer of Tongue caused by ragged edge of a carious or fractured Tooth?
42. Describe the process of tempering instruments?
43. For what affection is division or exsection of the inferior dental branch of the Fifth Pair sometimes resorted to? describe the operation?
44. Describe the operation of opening the Antrum, and the instruments necessary?
45. Would you extract a sound molar tooth, or make the opening into the Antrum, just above the first molar on the outer surface of its walls?
46. Describe the actual cautery, (galvanic), and the purposes for which it is used?
47. Name the three distinct causes to which deformities of the Hard and Soft Palates may be due?
48. Describe the use of Matrices in filling Teeth?

49. Describe the Electro-Magnetic Mallet?
50. Describe the Electric Mouth Lamp or Stomatoscope?
51. Describe the Dental Engine, and its uses?

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## DENTAL PROSTHESIS.

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### PREPARATION OF THE MOUTH.

1. What does the Preparation of the Mouth for an artificial denture consist in?
2. Name the conditions under which it is justifiable to extract teeth in this Preparation of the Mouth?
3. When it is desired on the part of the patient to retain certain teeth, name the points which are to be considered?
4. Why should all roots, as a general rule, be removed?
5. What exceptions are there to this general rule?
6. If any roots are permitted to remain, how should they be treated?
7. In the extraction of teeth and roots, what precaution should be observed?
8. How may one or more roots be utilized for the retention of artificial substitutes?
9. After the removal of teeth, what anatomical changes take place? and where do such changes occur?
10. What causes the absorption of the alveolus, describe the process?
11. How long a time does this process of absorption require in the case of an entire upper or lower set of natural teeth being removed at one time?

- 12. What effect upon this process of absorption has the wearing of a first or temporary artificial denture?
- 13. What is the effect of inserting an artificial denture when the mucous membrane of the mouth is inflamed?
- 14. Why are lower dentures often more difficult of adaptation than upper ones?
- 15. Does an irregular alveolar ridge prevent a denture from fitting well?
- 16. What causes the regular and uniform absorption of the alveolar ridge when no denture is worn?
- 17. What advantages result from wearing a temporary denture?
- 18. How soon after the extraction of the natural teeth should temporary artificial ones be inserted?
- 19. Should first or temporary sets be as skillfully made as permanent sets?
- 20. What is the effect of being without teeth for a long time?
- 21. How long is it necessary for a patient to wait until a full upper permanent set can be inserted?
- 22. What teeth are generally retained for clasps or stays when such are employed?
- 23. Why is it objectionable to allow a single tooth or roots of teeth, even if in a good condition, to remain in the lower jaw?
- 24. Under what circumstances would you permit the superior canines to remain?
- 25. What is the result of permitting teeth without antagonists to remain in the mouth?

## IMPRESSION MATERIALS, APPLIANCES AND METHODS.

1. What impression materials are in common use?
2. Name the requisites an impression material should possess?
3. What material gives the most accurate impression?
4. In how many forms does wax exist, and to what is its variation in color due?
5. How prepare wax from the crude form; how bleach it; the effect of bleaching; the adulterations, and the manner of detecting them?
6. What is the value of wax as an impression material; and what disadvantages has it?
7. What is the difference in chemical composition between white and yellow wax?
8. Describe the methods of preparing wax for dental use?
9. Describe the method of obtaining an impression with wax?
10. What effect does paraffine have when added to wax?
11. What is paraffine?
12. At what temperature is wax in a good condition for taking impressions?
13. Give the composition of modeling composition?
14. Name its advantages as an impression material?
15. Describe the method of taking an impression with modeling composition?
16. What is gutta percha; how is it prepared, and what properties does it possess?

17. What is its value as an impression material, and what disadvantages has it ?
18. Describe the method of taking an impression with gutta percha ?
19. At what temperature is it fit for taking impressions of the mouth ?
20. What are the solvents of gutta percha ?
21. Name the dental uses of gutta percha ?
22. What is Plaster of Paris ? its composition ?
23. What is its value as an impression material ? what are its disadvantages ?
24. Describe the methods of taking full and partial impression with Plaster of Paris ?
25. How is it prepared for dental use ?
26. What is meant by the setting of plaster ; describe the process ?
27. How determine the quality of plaster ?
28. What effect does cold and dampness have on it ?
29. Does it expand or contract on setting ?
30. What compensates for this change in some forms of work ?
31. What will hasten the setting of plaster ? the quantity of each agent ?
32. What precautions have to be observed in the use of a hastening agent ?
33. Does fine or coarse plaster give the hardest cast ?
34. Difference between dental plaster and commercial plaster ?
35. What effect has the quantity of water used in mixing plaster ? and is it best to add plaster to the water, or *vice versa* ? should the water be warm or cold ?

36. Describe the method of mixing plaster for impressions; also for casts?
37. Does the length of time the plaster is stirred in mixing, have any effect upon its expansion?
38. In what cases may other materials answer best for taking lower impressions?
39. Describe the preparation of the surfaces of impressions of the different materials?
40. What are the important requisites of an impression cup or tray?
41. Why is more care necessary in selecting a lower than an upper impression cup?
42. Describe the different forms of cup in use; also impromptu cups, material and mode of constructing?
43. What is the composition of Britannia metal?
44. Compositions of Sandarach and Shellac varnishes?
45. Give the composition of Teague's Impression Material and its object?

#### CASTS OR MODELS. DIES AND COUNTER-DIES.

1. Of what materials are Casts or Models made?
2. Describe the processes for making them?
3. How may plaster Casts or Models be hardened?
4. What does the setting property of plaster depend upon? is it admissible to use agents for aiding the setting in the case of Casts or Models?
5. In partial impressions how may the plaster teeth be strengthened?
6. Describe the methods of removing plaster casts from impressions of the different materials?

7. What different forms are given to casts of plaster for swaged and plastic work?
8. How is the plaster cast prepared for swaged and for plastic work?
9. Give the different forms of models for sand moulding, sectional, &c?
10. What is Liquid Silex, Collodion, composition of the soap solution, and their dental uses?
11. What is the advantage of a colored varnish for the impression?
12. What are dies and counter-dies?
13. What requisites should they possess?
14. What metals are usually employed in their construction?
15. What is the best formula for Babbitt's metal and the object of using it?
16. What is the composition of a proper fusible metal and the object of using such?
17. Describe the process of sand moulding, the kind of sand used and the process of preparing or tempering it?
18. Describe the different apparatus for sand moulding?
19. How are dies and counter-dies obtained without the use of sand?
20. How thick should the die ordinarily be made for swaging purposes?
21. What is a partial counter-die used for, and how is it made?
22. How are the undercuts of a plaster cast copied in the zinc or other metal die?
23. How is the metal of the counter-die prevented from fusing with that of the die?

24. Give the fusing points of the different metals used for dies and counter-dies?
25. When are block-tin dies and counter-dies serviceable? when are zinc counter-dies?
26. What compensates for the shrinkage of a zinc die?
27. What are the effects of having the moulding sand too moist: and the metal too hot?
28. In tempering sand, what may be substituted for the water, and for what purpose?
29. How can a die and counter-die, both of zinc, be constructed?
30. How can a counter-die be obtained when the die has lower melting point?

#### SWAGING, ETC.

1. What is the proper carat value for a gold plate?
2. Describe the process of preparing a gold plate from the ingot?
3. What thickness should a gold plate have in the case of an upper denture: what in case of a lower denture?
4. What is meant by the process of annealing?
5. Why is it necessary that a gold plate should be kept free from metallic contaminations, such as may result from particles of zinc or lead during the swaging process?
6. How may such contamination be prevented?
7. Describe the entire process of swaging a gold plate, beginning with the forming of the pattern?
8. How avoid plating or folding of the plate during the swaging process?

9. What acids are used for cleaning plates before annealing, and after swaging and soldering?
10. Should a plate after swaging fit the model or the die?
11. How construct plates with rims?
12. Preparation of the edges of a plate after swaging?
13. What are Spring Plates? What are Bridge Plates?

#### CLASPS, ARTICULATION, ADJUSTMENT OF TEETH, LINING OR BACKING AND SOLDERING.

1. Under what circumstances may clasps and partial stays prove serviceable?
2. Name the objections to use of clasps?
3. What teeth are best adapted for clasping?
4. Name the different forms of clasps?
5. Describe the construction of clasps?
6. Describe the methods by which clasps may be adjusted to the plate and the portion of tooth which should be embraced?
7. What point on the plate is best for the location of the clasp?
8. Are broad or narrow clasps most serviceable?
9. What does the term Articulation imply in dental prosthesis?
10. Describe the method of obtaining a proper Articulation or bite?
11. Describe the different motions of the jaw?
12. What is the most common error in attempting to obtain a correct bite?

13. How may the erratic movements of the jaw be controlled ?
14. How determine the median line.
15. Describe the different forms of articulators and their advantages ?
16. Describe the difference in the methods of obtaining the bite for swaged and plastic work ?
17. Of what are artificial teeth composed ?
18. Give a brief description of their manufacture ?
19. Describe the difference between plate teeth and those for other styles of dentures ?
20. Give the rules for selecting artificial teeth ?
21. Give the rules for adjusting such teeth ?
22. Give the method of grinding teeth and the appliances used ?
23. What is corundum ? What is emery ? Of what are the wheels for grinding teeth composed ?
24. Describe the method of adjusting and centreing a corundum wheel on a lathe-chuck ?
25. What kind of joints are made for swaged and for plastic work ?
26. How close should joints of gum teeth be made in metal work to be soldered ?
27. Give the preparation of the piece for soldering ? The composition and general form of the investment material and its treatment ?
28. Give the difference in composition between the Gold Plate and the Solder ?
29. Name the conditions for successful soldering ?
30. Describe the blow-pipe, (mouth and self-acting,) and its use ?
31. What is borax, and its use in soldering and in refining ?

32. Describe the methods used to prevent the warping of the plate during soldering?
33. What precautions are to be observed in cooling a piece after soldering?
34. Describe the process of finishing a gold set?

#### VACUUM CAVITIES.

1. Describe Atmospheric Pressure?
2. Give the difference between Adhesion and Cohesion?
3. What advantages do Vacuum Cavities give to the plate, and how long are they serviceable?
4. Has a perfect-fitting plate without a Vacuum Cavity, any advantages over one with such a Cavity?
5. Describe the formation of Vacuum Cavities, in impression, on model, by swaging and by soldering?
6. Can Vacuum Cavities be adapted to lower plates?

#### VULCANITE WORK.

1. What is Caoutchouc?
2. What is Vulcanite?
3. Give the composition of brown, black, red and pink Vulcanizable Rubbers?
4. What are the properties of Caoutchouc?
5. What are the solvents of Caoutchouc?
6. What are the effects of Acids and Alkalies upon Rubber?
7. What effect has exposure to the atmosphere on Rubber?
8. What is the chemical composition of Rubber?
9. How is crude Rubber purified?

10. What is the difference between the hard and soft Vulcanizable Rubbers ?
11. Which of the Dental Vulcanizable Rubbers is the strongest ?
12. What is Vermillion; has it any injurious effects after the rubber which contains it is vulcanized ?
13. What conducting properties of heat and electricity has Rubber ?
14. What is the cause of porosity in Vulcanizing Dental Rubber ?
15. Why cannot silver be used in connection with Vulcanite ?
16. How is the Weighted Rubber prepared, and for what purpose ?
17. Why cannot Gutta Percha incorporated with Sulphur, be used for the construction of Dentures ?
18. What properties must Dental Vulcanite possess ?
19. Describe the Teeth used for Vulcanite Work ?
20. Describe the process of constructing a Vulcanite set of Teeth, full and partial sets ?
21. Describe the apparatus used to Vulcanize Rubber ?
22. How can the rubber be prevented from showing between the joints of sectional blocks ?
23. How can every particle of wax be removed from the flask mould, and what is the necessity for doing so ?
24. Describe the methods for gauging the quantity of rubber to be used in packing a case ?
25. At what temperature is it usual to vulcanize ?

26. Do the brown and black vulcanites require more time than the pink and red to vulcanize?
27. Why should thermometers be tested before using?
28. How may thick masses of rubber be vulcanized?
29. What is the steam pressure to the square inch in the boiler of the vulcanizer at 300° F., at 320°, at 330°, at 340°, at 350°, at 360°, at 400°?
30. Describe the process of finishing a vulcanite plate?
31. Describe the process of repairing vulcanite sets for split plates and loss of teeth?
32. Describe the process of duplicating a rubber set?
33. What is the effect of a second or third vulcanizing on a rubber plate?
34. How may plate teeth be used on a vulcanite plate; and for what purpose are such teeth used?
35. Describe the use of vulcanite with a swaged plate?
36. What will prevent the rubber from adhering to a plaster surface after vulcanizing?
37. How may a polished surface be obtained on vulcanizing?
38. What advantage is there in using a block-tin cast on which to vulcanize, or coating the plaster surface with tin foil?
39. Name the uses in dental practice of vulcanized rubber in other cases than attaching artificial teeth?
40. What effect has the admixture of coloring materials upon the strength of rubber?
41. Describe the process of removing teeth from an old rubber plate?

## CELLULOID AND ZYLONITE.

1. What is the composition of Dental Celluloid?
2. Describe its preparation?
3. What is Pyroxylin?
4. How does the strength of Celluloid compare with that of Vulcanite?
5. In what forms is the celluloid prepared for dental use?
6. Has it any advantages over vulcanite, and what are its disadvantages?
7. What quality of plaster should be used in constructing a celluloid set?
8. In what respects does the process of constructing a celluloid set differ from that of vulcanite?
9. Can celluloid be repeatedly softened without injury to the material?
10. Why are metal casts preferable to plaster casts in manipulating celluloid?
11. What is the principal solvent of celluloid?
12. How may a plaster cast be strengthened for use with celluloid?
13. What form of teeth are usually employed in celluloid sets?
14. May gum teeth in form of sectional blocks be used, and what precautions are necessary?
15. Are special flasks and apparatus for moulding celluloid necessary; describe such?
16. How determine the size of the celluloid blank necessary?
17. Is dry or moist heat preferable in manipulating celluloid?

18. How may you define the rugae on the lingual surface of a celluloid plate?
19. After placing piece in heater at what temperature does the celluloid begin to soften?
20. What is the maximum temperature in moulding celluloid, and at what stage of the process should the heat be turned off?
21. What precautions are necessary in regard to the pressure applied to the flask?
22. When moist heat is used from what liquids may it be obtained?
23. Describe the moulding of celluloid in oil and in glycerine?
24. Why is it dangerous to raise the temperature above 280°?
25. Does celluloid weld perfectly in the moulding process?
26. To what class of cases is celluloid particularly adapted?
27. Does it require more pressure in moulding than vulcanite?
28. Describe the process of constructing a combination set of rubber and celluloid?
29. Describe the process of repairing a celluloid set?
30. Describe the process of finishing a celluloid set after it is moulded?
31. Does any deleterious effect result from cutting into the surface of a celluloid set after moulding?
32. What special precautions are to be observed in wearing a celluloid denture?
33. Can celluloid be employed in repairing a vulcanite plate?

34. In what respect does Zylonite differ from Celluloid in its composition?
35. Has Zylonite any advantages over Celluloid?
36. Does the process of moulding Zylonite differ from that of Celluloid?

#### METALLO-PLASTIC WORK.

1. What is metallo-plastic work?
2. Name the metals used alone and in the form of alloys in this work?
3. Describe the processes by which Woods', Weston's, Watts', Hayford's and Reese's alloys are manipulated in metallo-plastic work?
4. To what class of cases is such work adapted on account of weight?
5. Describe the apparatus in use for metallo-plastic work?
6. At what temperature do the more fusible of these alloys melt?
7. What preparation of the matrix is necessary before pouring the alloy?
8. Describe the process of finishing such work?
9. What is the advantage of electro plating it?
10. What is stanno-plastic work?

#### PIVOT AND BRIDGE WORK.

1. What preparatory treatment is often necessary in the operation of pivoting?
2. Name the classes of teeth to the roots of which are generally attached artificial crowns?
3. What instruments are necessary in performing such an operation?

4. Describe the process of inserting crowns on wood pivots?
5. State the objections against such pivots?
6. Describe the different processes of inserting crowns on metallic pivots?
7. Describe the preparation of the root to prevent pathological conditions?
8. Describe Bean's, Thomas', Webb's, Flagg's, Boice's, Weston's, Carman's, Leech's, Bonwill's, How's, Logan's, Rambo's, Register's, Bishop's, methods?
9. Describe the process of constructing Dwinell's, Morrison's, Richmond's, Buttner's, cap Crowns?
10. How may artificial Crowns be attached to natural Teeth without plates or clasps?
11. What is meant by Bridge-work?
12. Describe Bing's, Leech's, Register's, Webb's, Williams', methods?
13. State the advantages and disadvantages of bridge or graft work?

#### OBTURATORS AND ARTIFICIAL PALATES.

1. What is an Obturator, and how constructed?
2. What appliance may be constructed to remedy Cleft Palate?
3. Describe the methods of obtaining an impression of the parts in order to construct an Artificial Palate?
4. With what solutions may the parts be painted to render them sufficiently insensible to endure the contact of the impression material?
5. What material is best adapted for obtaining such impressions?

6. What is the best form of cup for obtaining such an impression?
7. What precautions are to be observed, and what requisites should the impression material possess?
8. At what stage of the setting process should the impression be removed?
9. How treat the impression after it is obtained, and in what metal is it best to duplicate the plaster models?
10. For artificial velae what form of rubber is used? also the process of vulcanizing it?
11. The hard palate portion of appliance can be constructed of what form of rubber? Can teeth be added?
12. What retains such an appliance?
13. What precautions have to be observed in cases of Cleft palate from Syphilitic ulceration?
14. Describe the process of constructing an artificial palate?
15. Is metal or plaster better for the matrix in vulcanizing soft rubber?

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## DENTAL MATERIA MEDICA AND THERAPEUTICS.

1. Define the term Materia Medica?
2. Define the term Therapeutics?
3. Describe the influence of Age, Sex, Temperament, Habit and Mode of Life, Occupation, Condition of Body, Mind, Idiosyncrasy, Nature of Tissue

or Organ, and Climate, in modifying the effects of medicinal substances?

4. Describe the characteristic Indications of the Tongue?
5. Give the table of Weights, Measures, etc.?
6. Give the Rules for Regulating Doses?
7. Describe the Symptoms and Antidotes of the principal Poisons?
8. Describe the Pulse and the Manner of Observing it?
9. Give the table of Variations in the frequency of the Pulse from Infancy to Old Age?
10. Describe the Relation of the Pulse with the Temperature of the Body?
11. Give the Respiration at various ages?
12. Describe the difference in the number of degrees between the various Thermometers?
13. Describe the Clinical Thermometer?

#### CLASSIFICATION OF MEDICINAL AGENTS.

1. What are Astringents?
2. " " Styptics or Hæmostatics?
3. " " Anæsthetics?
4. " " Antacids?
5. " " Alteratives?
6. " " Antiperiodics?
7. " " Antispasmodics?
8. " " Antiseptics?
9. " " Antilithics?
10. " " Anthidrotics?
11. " " Anthelmintics?
12. " " Cathartics?

13. What are Laxatives?
14. " Purgatives?
15. " Drastics?
16. " Enemata?
17. " Carminatives?
18. " Counter-Irritants?
19. " Diaphoretics?
20. " Detergents?
21. " Dessicatives?
22. " Diuretics?
23. " Disinfectants?
24. " Emetics?
25. " Escharotics?
26. " Emollients?
27. " Excitants?
28. " Epispastics?
29. " Expectorants?
30. " Emmenagogues?
31. " Febrifuges?
32. " Gargles?
33. " Hypersthenics?
34. " Injections?
35. " Lithiontriptics?
36. " Narcotics?
37. " Anodynes?
38. " Soporifics?
39. " Hypnotics?
40. " Neurotics?
41. " Nervines?
42. " Refrigerants?
43. " Sialagogues?
44. " Stimulants?
45. " Tonics?

46. What are Sedatives ?

47. " " Spinants ?

48. " " Blennorrhetics ?

49. " " Haematinics ?

50. " " Irritants ?

51. " " Demicents ?

52. " " Absorbents ?

53. " " Antemetics ?

54. " " Caustics ?

55. " " Deodorizers ?

56. " " Diluents ?

57. " " Discutients ?

58. " " Errhines ?

59. " " Evacuants ?

60. " " Excitants ?

61. " " Haemostatics ?

62. " " Nutritives ?

63. " " Resolvents ?

64. " " Restoratives ?

65. " " Vesicants ?

66. Give an example of each Class ?

67. Name the Forms in which medicinal substances are employed ?

Give the Officinal Name, Preparation or Composition or Portion used, Appearance, Properties, General Medicinal and Surgical Uses, Dose when used internally, and Uses in Dental Practice of the following Agents :

68. Prepared or Precipitated Chalk ?

69. Orris Root ?

70. Peruvian Bark and its preparations ?

71. Cinnamon ?

72. Borax?
73. Bicarbonate of Soda?
74. Creosote?
75. Carbolic Acid?
76. Glycerine?
77. Iodine and its preparations?
78. Aconite?
79. Galls? Gallic Acid?
80. Tannin and its preparations?
81. Nitrate of Potassa?
82. Iodide of Potassium?
83. Chlorate of Potassa?
84. Caustic Potassa?
85. Permanganate of Potassa?
86. Sulphite, Hyposulphite and Bisulphite of Soda?
87. Solution of Chlorinated Soda?
88. Arsenious Acid?
89. Cobalt?
90. Morphia,—Acetate, Sulphate, Muriate?
91. Oil of Cloves?
92. Terchloride of Gold?
93. Nitrate of Silver?
94. Chloride of Zinc?
95. Oxide of Zinc?
96. Sulphate of Zinc?
97. Chromic Acid?
98. Pyrethrum?
99. Xanthoxylum?
100. Acetate of Lead?
101. Per Sulphate of Iron?
102. Powd. Subsulphate of Iron?
103. Chloride of Iron?

104. Alum ?
105. Lime Water ?
106. Atrophy—Sulphate of Atrophy ?
107. Arnica ?
108. White Oak Bark ?
109. Camphor ?
110. Bromide of Camphor ?
111. Calendula ?
112. Bromine—Bromide of Potassium ?
113. American Hellebore ?
114. Witch Hazel—Hamamelis ?
115. Collodion ?
116. Cantharidal Collodion ?
117. Cayenne Pepper—Capsicum ?
118. Chloride of Lime ?
119. Opium and its preparations ?
120. Carvacrol ?
121. Pepsin ?
122. Iodoform ?
123. Yellow Jasmin—Gelsemium ?
124. Salicylic Acid ?
125. Alcohol—Absolute Alcohol ?
126. Sandarach ?
127. Shell-lac ?
128. Myrrh ?
129. Gum Arabic—Acacia ?
130. Thymol—Glycerole of Thymol ?
131. Tartaric Acid ?
132. Chlorine ?
133. Litmus ?
134. Sulphuric Acid ?
135. Hydrochloric Acid ?
136. Acetic Acid ?

137. Nitric Acid ?
138. Benzoic Acid ?
139. South Am. Soap Tree Bark ?
140. Oil of Sweet Almonds ?
141. Phenate or Carbolate of Soda ?
142. Rhigolene ?
143. Eucalyptus ?
144. Vaseline ?
145. Acetate of Alumina ?
146. Phosphate of Zinc ?
147. Menthol ?
148. Aconitine, Duquesnel's ?
149. Boracic Acid ?
150. Acetate of Ammonia Solution ?
151. Phosphoric Acid ?
152. Aromatic Sulphuric Acid ?
153. Terchloride of Phenol ?
154. Ammonia Alum ?
155. Carbonate of Ammonium ?
156. Chloride of Ammonium ?
157. Nitrate of Amyl ?
158. Amylene ?
159. Antiseptic and Styptic Cotton ?
160. Bichloride of Mercury—Corrosive Sublimate ?
161. Belladonna ?
162. Benzoated Lard ?
163. Subnitrate of Bismuth ?
164. Bromide of Camphor ?
165. Bromide of Ethyl ?
166. Bromide of Potassium ?
167. Butyl Chloral Hydrate ?
168. Calcium ?
169. Carbolate of Sodium ?

170. Chloral Hydrate? Croton Chloral Hydrate?
171. Chinoline?
172. Chloride of Magnesium?
173. Chloride of Tin?
174. Chloroform?
175. Sulphuric Ether?
176. Nitrous Oxide Gas?
177. Chloric Ether?
178. Bichloride of Methylene?
179. Cocaine and its preparations?
180. Glyceroborates of Calcium and Sodium?
181. Bichloride of Ethidene?
182. Elixir of Vitriol and Tannic Acid?
183. Sulphate of Magnesia?
184. Eugenol?
185. Fused Potassa?
186. Glacial Phosphoric Acid?
187. Glycerites?
188. Gutta Percha?
189. Hoffman's Anodyne?
190. Mercury and its preparations?
191. Hydrate of Potash?
192. Hydrochlorate of Ammonia?
193. Hydrobomic Ether?
194. Hypophosphite of Quinine?
195. Green Iodide of Mercury?
196. Iodide of Zinc?
197. Jamaica Dogwood?
198. Krameria?
199. Listerine?
200. Matico?
201. Mel Boracis?
202. Mercurial Ointment?

203. Methyl Ether? Methyl Ethylic Ether?

204. Ammonia?

205. Napthalin?

206. Sanitas Oil?

207. Cajaput Oil?

208. Oleate of Mercury?

209. " Aluminium?

210. " Bismuth?

211. " Copper?

212. " Zinc?

213. " Lead?

214. " Arsenic?

215. Papain?

216. Pinus Canadensis?

217. Piscidia Erythrina?

218. Oxide of Potassium?

219. Phosphoric Acid?

220. Potassa Alum?

221. Sulphate of Quinine?

222. Resorcin?

223. Quinoline?

224. Protiodide of Mercury?

225. Sal Ammoniac?

226. Syrup of Lacto-phosphate of Lime?

227. Sulphate of Cadmium?

228. Spirit of Mindererus?

229. Styptic Colloid?

230. Sulphate of Copper?

231. Sulpho-Carbolate of Zinc?

232. " " Sodium?

233. " " Potassium?

234. " " Magnesium?

235. " " Calcium?

236. Sulpho-Carbolate of Quinine?
237. Sulpho-Carbolic Acid?
238. Tartrate of Chinoline?
239. Trichloroacetic Acid?
240. Teriodide of Formyl?
241. Valerianate of Ammonium?
242. Veratrine?

### ANÆSTHETICS.

1. Name the principal General Anæsthetics in use?
2. What is meant by a General Anæsthetic?
3. Describe the manner in which Anæsthetics act upon the System?
4. Describe the Stages through which the patient passes while inhaling Anæsthetics?
5. Name the Conditions which render the Inhalation of Anæsthetics dangerous?
6. Describe the Dangerous Symptoms during the Inhalation of Anæsthetics?
7. Describe the Preventive Measures against Danger from Anæsthetics?
8. Describe the Treatment of Dangerous Symptoms?
  - a. Marshall Hall's Ready Method?
  - b. Nelaton's Method?
  - c. Other Methods of Artificial Respiration?
9. What Agent is considered to be an Antidote to Chloroform Narcosis by its Stimulating action on the Heart?

Describe the Effects and Administration of—

10. Sulphuric Ether?
11. Chloroform?

12. Chloric-Ether?
13. Nitrous-Oxide Gas?
14. Bichloride of Methylene?
15. Hydrate of Chloral?
16. Croton Chloral Hydrate?
17. Bromide of Ethyl?
18. Describe the Method of Obtunding Pain by Rapid Breathing, and the Theory concerning its Action?
19. Describe the Manner of Administering General Anæsthetics and the Dose of each for Dental Operations?
20. What is a Local Anæsthetic?
21. Name the Different Methods and Agents by the use of which Local Anæsthesia can be produced?

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## ANATOMY.

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### BONES.

1. What is the number and names of bones in the adult skeleton?
2. What is the number and names of bones in the head?
3. Describe the Frontal Bone?
4. Describe the Parietal Bones?
5. Describe the Occipital Bone?
6. Describe the Temporal Bones?
7. Describe the Sphenoid Bone?
8. Describe the Ethmoid Bone?
9. Describe the Nasal Bones?

10. Describe the Superior Maxillary Bones?
  - a. What four surfaces has the body of each bone?
  - b. Where is the incisive fossa?
  - c. Where is the canine fossa?
  - d. Where is the infraorbital foramen?
  - e. Where is the maxillary tuberosity?
  - f. Where are the turbinated crests?
  - g. Where is the vertical groove?
  - h. Where is the rough surface for articulation with the palate bone?
  - i. Where is the orbital surface and with what bones does it articulate?
  - j. Where is the infraorbital groove and what does it end in?
  - k. Where is the depression for the origin of the inferior oblique muscle of the eye?
  - l. How many processes has the superior maxillary bone?
  - m. Describe the malar process?
  - n. Describe the nasal process?
  - o. Describe the alveolar process?
  - p. Describe the palate process?
  - q. Describe the articulations of the superior maxillary?
  - r. Name the muscles attached to this bone?
11. Describe the Inferior Maxillary Bone?
  - a. What parts compose the body and the two rami?
  - b. Describe the alveolar portion?
  - c. Describe the symphysis?
  - d. Describe the mental process?

- e. Where is the mental foramen and what does it transmit ?
- f. Where is the incisive fossa and what muscle does it give origin to ?
- g. Where is the external oblique line, and what muscles does it give origin to ?
- h. Where is the groove for the passage of the facial artery ?
- i. Where are the genial tubercles and to what muscles do they give origin ?
- j. Where is the mylo-hyoid ridge and to what muscle does it give origin ?
- k. Describe the rami ?
- l. Describe the coronoid process and what muscle does it give insertion to ?
- m. Describe the condyloid process, with what fossa does its condyle articulate with, and what muscle does it give insertion to ?
- n. Describe the sigmoid notch; what does it separate, and what vessels and nerve cross it ?
- o. Where is the groove for the attachment of the buccinator muscle ?
- p. Where is the spine for the attachment of the internal lateral ligament of the jaw ?
- q. Where is the inferior dental canal, and what vessels and nerve does it transmit ?
- r. Where is the mylo-hyoid groove; for what vessels and nerve ?
- s. Where are the ridges for the insertion of the masseter muscle ?
- t. Where is the rough surface for the internal pterygoid muscle ?

- u. Describe the angle of the jaw, and name the muscles and ligament inserted there?
- v. Describe the temporo-maxillary articulation?
- w. Name the muscles attached to the inferior maxillary bone?
- 12. Describe the Malar bones?
  - a. Describe the Zygomatic process?
- 13. Describe the Lachrymal bones?
- 14. Describe the Palate bones?
  - a. What does the horizontal plate form?
  - b. Where is the ridge for the tensor palati aponeurosis?
  - c. Where is the groove which assists in forming the posterior palatine canal?
  - d. Where is the foramina transmitting the anterior and posterior palatine nerves?
  - e. What bone does the anterior border join?
  - f. What does the posterior border give attachment to?
  - g. What does the groove of the inner border receive?
  - h. What muscle does the posterior nasal spine give origin to?
  - i. Describe the vertical plate?
  - j. Describe the pterygoid process?
  - k. Describe the orbital process?
  - l. With what bones does the palate bone articulate?
  - m. Name the muscle attached to this bone?
- 15. Describe the Inferior Turbinated Bones?
  - a. What duct does the lachrymal process aid in forming?

*b.* What processes partially close the opening into the antrum?

16. Describe the vomer?
17. Describe the orbits of the eyes?
18. Describe the nasal fossae, the temporal fossa, the zygomatic fossa?
19. Describe the sutures and fontanelles of the skull?
20. Describe the hyoid bone?
21. Describe the base of the skull?
22. Describe the vertebral column?
23. What is the thorax; what structures are contained in it?
24. Describe the sternum?
25. Describe the ribs; number and characteristics?
26. What is the pelvis; diameters in female and male?
27. Describe the sacrum, coccyx and ossa inominata?
28. Describe the ilium, the ischium and the pubes?
29. Describe the shoulder joint?
30. Describe the clavicle and scapula?
31. Describe the axillary space?
32. Describe the arm, forearm and hand?
33. Describe the humerus?
34. Describe the ulna and radius?
35. Describe the carpal and metacarpal bones and the phalanges?
36. The thigh; describe the femur?
37. The leg; describe the tibia, the fibula?
38. The foot; describe the tarsal, the metatarsal bones, and the phalanges of the foot?
39. Describe the three classes of articulations; the synarthroses, the diarthroses, and the amphiarthroses?

40. Describe the elbow-joint; and the wrist joint?
41. Describe the hip joint; and the knee and ankle joints?
42. Name the bones of the head, the trunk, the upper extremity, the lower extremity?
43. Describe the structure of bone, and its composition?
44. Describe the marrow; also the process of ossification?
45. Describe the antrum?
  - a. The size and shape and thickness of its walls?
  - b. The appearance of the floor, and the relation of the latter to the roots of the teeth?
  - c. The membrane lining this cavity, and the opening?
  - d. What teeth are directly under the antrum?

#### MUSCLES AND FASCIAE.

1. Give a general description of muscle and fascia?
2. Describe the muscles of the head? Name the muscles of expression?
3. Describe the muscles of mastication?
4. What muscles depress, raise, protrude, and draw back the lower jaw?
5. What muscles control the movements of the tongue?
6. What are the muscles of the soft palate?
7. What are the pillars of the fauces formed by?
8. Name the muscles of the ear?
9. Describe the muscles of the neck?
10. What muscles are connected with the hyoid bone?

11. Describe the muscles of the throat ?
12. Describe the muscles of the back ?
13. Describe the muscles of the abdomen ?
14. Describe the muscles of the thorax ?
15. Describe the muscles of the perineum ?
16. Describe the muscles of the shoulder, arm, forearm and hand ?
17. What are fasciae ? Describe the fasciae of the hand ?
18. Describe the muscles of the hip, thigh, leg and foot ?
19. Describe the fasciae of the foot ?

#### ARTERIES, VEINS.

1. Give a general description of arteries and veins, their structure, etc. ?
2. Describe the coronary and the innominate arteries ?
3. Describe the aorta ?
4. Describe the common carotid artery ?
5. Describe the external carotid artery ? also its branches—the superior thyroid, the lingual, the facial, the occipital, the posterior auricular, the ascending pharyngeal, the temporal and the internal maxillary ?
6. What two principal arteries supply the face ?
7. What artery supplies the dental branches ?
8. Describe the artery supplying the inferior teeth ?
9. What arteries supply the superior teeth ?
10. Describe the internal carotid artery, and its terminal branches ? describe the "Circle of Willis" ?
11. Describe the subclavian, the basilar, the thyroid axis ?

12. Describe the axillary, the brachial, the radial, the ulnar, their branches and the palmar arch ?
13. Describe the thoracic aorta, and its branches ?
14. Describe the abdominal aorta, and its branches ?
15. Describe the common, the internal and the external iliac arteries ?
16. Describe the femoral, the popliteal, anterior and posterior tibial, arteries ?
17. Describe the dorsalis pedis, the internal and external plantar arteries, and branches ?
18. Describe the pulmonary artery, the kind of blood it conveys to the lungs, the side of the heart this blood is conveyed from, and its terminal branches ?
19. Into what classes are the veins divided ?
20. Describe the principal veins of the head and neck ?
21. Describe the cardiac veins ?
22. Describe the principal veins of the thorax, of the upper and lower extremities, and the pulmonary veins ?
23. Describe the portal system ?
24. Describe the vascular supply of the dental periosteum, of the gums, and of the oral mucous membrane ?

### THE ABSORBENTS.

1. What are the Lymphatics ?
2. What are the Lacteals ?
3. What are the Lymphatic Glands ?
4. Describe the Lymphatic and Thoracic Ducts ?
5. Describe Scarpa's Triangle ?

## THE NERVES.

1. Give the divisions of the Nervous System ?
2. Describe the structure of Nerve-Tissue ? and of white nerve matter ?
3. What composes the Cerebro-Spinal System ?
4. Describe the membranes of the Brain, and name the parts which compose this organ ?
5. Describe the Cerebrum, the Cerebellum, the Pons Varolii and the Medulla Oblongata ?
6. What are the Commissures, the Ventricles and the Ganglia of the Brain ?
7. Describe the Spinal Cord ?
8. Give the number and names of the Cranial Nerves ?
9. Describe the Olfactory Nerve ?
10. Describe the Optic Nerve ?
11. Describe the Motor Oculi and the Patheticus ?
12. Describe the Trigeminus or Fifth pair of Nerves, its origin and distribution and character ?
  - a. The Ophthalmic Branch ?
  - b. The Superior Maxillary Branch ?
  - c. The Inferior Maxillary Branch ?
13. What Cranial Nerves supply the teeth ?
14. Give the origin of the Dental Branches ?
15. What nerves supply the Muscles of Mastication ?
16. What nerves supply the Muscles of Expression ?
17. What nerves supply the Gums, the Oral Mucous Membrane and the Dental Periosteum ?
18. Describe the Abducens Nerve ?
19. Describe the Facial Nerve ?

20. Describe the Auditory or Portio Mollis ?
21. Describe the Glosso-Pharyngeal Nerve ?
22. Describe the Pneumogastric or Par Vagum ?
23. Describe the Spinal Accessory and also the Hypo-Glossal ?
24. Describe the Spinal Nerves ?
25. Describe the Cervical, Brachial, Lumbar and Sacral Plexuses ?
26. Describe the Sympathetic Nerve ?
27. Describe the Casserian Ganglion ?
28. Name the four Ganglia connected with the Fifth pair, each of which has a Motor, a Sensory and a Sympathetic root ?

#### THE HEART, LUNGS, LARYNX AND TRACHEA.

1. Give a general description of the Heart ?
  - a. Describe its position and structure ?
  - b. Describe the auricles and ventricles ?
  - c. Describe the aortic opening, the valves, veins and fleshy columns ?
2. Describe the Pericardium and Endocardium ?
3. Give a general description of the Lungs ?
  - a. Describe the difference between the right and left Lungs ?
  - b. Describe the Parenchyma ?
  - c. Describe the Lobes ?
  - d. Describe the Pleurae ?
  - e. Describe the Mediastinum ?

## THE ORGANS OF THE VOICE AND RESPIRATION.

1. Describe the Larynx ?
2. Describe the Glottis ?
3. Describe the Vocal Cords ?
4. Describe the Trachea ?
5. Describe the Bronchial Tubes ?
6. Give the difference between the right and left Bronchus ?

## THE URINARY ORGANS.

1. Give a general description of the Kidneys, structure, etc. ?
  - a. The Cortical substance, the Medullary substance, the Malpighian bodies, the Ducts ?
2. Describe the Ureters, the Supra-Renal Capsules, the Bladder, the Urethra ?

## THE ORGANS OF DIGESTION.

1. The Mouth: give its shape, how it is bounded and what it is lined with ? also its vascular and nervous supply ?
2. The Lips: describe them, and also the Fraena ?
3. The Cheeks: describe what they form, what compose them, name of the principal muscle, names of the other muscles of the cheeks, the apertures of the duets and their location ?
4. The Gums: their structure, connection with the periosteum and teeth, their sensibility and their papillae ?

5. The Palate: describe the hard and soft palates, the uvula, the arches or pillars and aponeurosis of the velum pendulum palati, the isthmus of the fauces, the tonsils, the muscles, arteries and nerves ?
6. The Salivary Glands: give the number, names, and location of the principal salivary glands, describe their form, size, ducts, structure and vessels and nerves ?
7. Describe the Labial and Buccal Glands ?
8. Describe the Pharynx and Aesophagus ?
9. Describe the Abdomen and Peritoneum ?
10. Describe the Stomach and the small and large Intestines ?
  - a. Describe the structure of the Stomach, its form, situation and alterations in position and connections ?
  - b. Describe the three portions composing the small Intestine ?
  - c. Describe the extent, structure and portions composing the large Intestine ?
11. The Liver: give a general description of the Liver ?
  - a. Describe the Lobes, the Hepatic Cells, and the Biliary Ducts ?
  - b. Describe the structure of the Liver and its situation ?
12. Describe the Gall-Bladder ?
13. Describe the Pancreas ?
14. Describe the Spleen ?
15. Describe the Generative Organs ?
16. Describe the Surgical Anatomy of Inguinal and Femoral Hernia ?

- a. The anatomical difference between Congenital and Acquired Hernia, between Direct and Oblique ?
- b. Describe Poupart's Ligament ?

### ORGANS OF THE SENSES.

- 1. Give a general description of the Skin ?
  - a. Describe the Derma or Cutis Vera: its two layers ?
  - b. Describe the Epidermis or Cuticle ?
  - c. Describe the cells of the Epidermis ?
  - d. Difference between the skin of the male and female ?
  - e. Describe the appendages of the skin ?
- 2. Describe the Tongue, its special sense ?
  - a. Describe its different portions ?
  - b. Describe its Papilla, Glands, and Follicles ?
- 3. Describe the Nose ?
- 4. Describe the Nasal Fossae ?
- 5. Describe the Eye ?
  - a. The Sclerotic and Cornea, the Choroid, Iris and Ciliary process ?
  - b. The Retina, Aqueous humor, Vitreous body, Crystalline lens and its Capsule ?
  - c. The appendages of the Eye ?
  - d. The Lachrymal apparatus ?
- 6. Describe the Ear ?
  - a. The external Ear ?
  - b. The middle Ear or Tympanum ?
  - c. The internal Ear or Labyrinth ?
  - d. Describe the bones of the Ear ?

6\*

## PHYSIOLOGY.

1. Describe the nutritive animal and reproductive functions of the human body ?
2. How many of the chemical elements enter into the composition of the body, and what are they ?
3. What are the four classes of proximate principles that exist in the body ?
  - a. What effect has water upon the tissues ?
  - b. What effect has sodium chloride upon the blood corpuscles ? and what is the only solid body in which it is not found ?
  - c. Where is oxygen; hydrogen; nitrogen; carbonic anhydride; carburetted and sulphuretted hydrogen; water; sodium chloride; potassium chloride; calcium chloride, carbonate and phosphate; magnesium, sodium and calcium phosphates; sodium and potassium sulphates; sodium, potassium and magnesium carbonates found in the different organs, fluids and solids of the body ?
  - d. What do the neutral fats and fatty acids constitute, from what are they derived, and what purposes do they serve in the body ?
  - e. In what tissues and fluids of the body is sugar found ?
  - f. In what tissues and fluids are albumen, peptone, fibrin, casein, ostein, myosin, mucin, chondrin, elastin, heratin and globulin found ?

- g. What are the principles that represent waste in the body and what is their origin ?
  4. Give the names of the structures composing the body ?
  5. What are the fundamental and structural elements of the tissues ?
  6. Describe the structure, substance, growth, reproduction and motion of cells.
  7. Give a classification of the tissues of the body ?

### FOOD.

1. Give the definition and function of food ?
  - a. Define hunger, thirst, inanition or starvation ?
  - b. How do the alimentary principles, bread, meat, milk, eggs, etc., etc., form compound substances in the body ?
  - c. What three kinds of food does the body need ?
  - d. What is the estimated amount of food required in 24 hours ?

### DIGESTION.

1. Define the process of digestion.
2. Name the organs composing the digestive apparatus.
3. Name the seven stages of digestion, and describe each stage.
4. Describe the function of the teeth.
5. What directs the movements of mastication ?

6. Describe Mucus and its uses.
7. Describe the Saliva, its composition, properties and functions, both physical and chemical.
  - a. What tends to check or increase the flow of saliva ?
8. What is insalivation, and what nerves are concerned in this process ?
9. Describe the three stages in the act of deglutition.
10. What is the gastric juice; its principal action; abundance and the average length of gastric digestion ?
  - a. To what is the acidity of the gastric juice due ?
  - b. What influences its flow ?
  - c. What is the appearance of the food as it passes through the pylorus ?
  - d. How is pepsin prepared ; and why is not the stomach itself digested ?
11. What is assimilation ?
12. Describe the movements of the stomach.
13. For what does the pylorus open ?
14. Describe intestinal digestion.
15. What fluids are secreted in the duodenum ?
16. Describe the pancreatic juice, its origin or source, composition, properties and functions.
  - a. What quantity is secreted in 24 hours ?
17. Describe the bile, its composition, properties and functions.
  - a. What quantity is secreted in 24 hours ?
18. What does the liver secrete from the blood besides the bile ?

19. What is the appearance of the food when it leaves the duodenum?
20. How does the blood receive nutritious matter from the food?
21. What do the faeces consist of?
22. What are the gases contained in the stomach and small intestine; what in the large intestine?
  - a. Give the origin and functions of these gases?
23. What is chyme; and what reduces the food to this condition?
24. What is chyle? where does the chyle pass to?

### ABSORPTION.

1. Describe the process of absorption; what is its object, and in what two ways is it performed?
  - a. What are the agents of absorption?
  - b. What particular veins are most active in this process?
  - c. How long does it last?
2. Describe the lacteals or lymphatics.
  - a. To what general system do they belong?
  - b. What do the veins absorb, and where do they carry the food?
  - c. What absorbs the principal part of the fat?
  - d. What part do the villi of the intestines perform?
3. What duct is the general trunk of the lymphatic system?
4. Describe lymph; its origin, nature and composition?
  - a. What are leucocytes, and into what are they discharged.

- b. What is the quantity of lymph entering the thoracic duct in 24 hours ?
- 5. By what two routes do the products of digestion find their way into the general circulation ?
- 6. Name the forces which aid the movements of lymph and chyle.
- 7. What becomes of the molecules of fat ?
- 8. What do the lacteals contain during the intervals of digestion ?

#### BLOOD CIRCULATION.

- 1. What is blood ? give its composition, properties and functions ?
  - a. Of what two portions does it consist ?
  - b. Describe the plasma or liquor sanguinis.
  - c. Describe the red and white corpuscles, origin, etc.
  - d. What is haemoglobin ?
  - e. What does haematin result from ?
  - f. What is fibrin ? what is serum ? what is albumen ?
  - g. What causes the blood to coagulate ?
  - h. What conditions influence coagulation ?
  - i. The difference between arterial and venous blood.
  - j. What is the difference in color owing to ?
  - k. How much blood is in the body according to its weight ?
  - l. What is its opacity due to, also its saline taste, the degree of its alkalinity ?
  - m. How does the temperature range ?
- 2. Name the organs composing the circulatory apparatus.

3. What is the function of the heart?
4. What is the object of the circulation?
5. Describe the course of the blood through the heart.
6. After the blood leaves the right ventricle of the heart how does it reach the lungs?
7. What change does the blood undergo in the lungs?
8. What is the course of the blood after it leaves the left ventricle of the heart?
9. After the blood is distributed to the system at large by what vessels is it again returned to the heart?
10. What is meant by systole and diastole?
11. How is regurgitation from the ventricles into the auricles, and from the pulmonary artery and aorta into the ventricles prevented?
12. Describe the movements of the heart.
13. Describe the sounds of the heart.
14. Describe the variation in the frequency of the heart's action at different ages—infancy, childhood, adult age.
15. What influence have exercise, posture and digestion on the heart's action?
16. What are the rhythmical movements of the heart dependent upon?
17. What influence has the nervous system?
18. What do the properties elasticity and contractility enable the arteries to perform?
19. Describe blood pressure, and state what it is influenced by.
20. What is the pulse? and what is the rate of movement of the blood in the arteries and veins?

21. What is the passage of the blood through the capillaries due to?
22. Describe the valves of the arteries and veins.
23. Name the propelling powers of the blood.
24. Name the five forces which keep the blood in circulation.
25. What is the time required for a complete circulation of the blood throughout the vascular system?

### RESPIRATION.

1. What is the object or function of respiration?
2. What organs constitute the respiratory apparatus?
3. Describe the two respiratory movements.
  - a. The effect upon the chest of inspiration.
  - b. The effect of expiration.
4. Describe the movements of the glottis.
5. What are the involuntary and reflex movements of respiration controlled by?
6. In the young, what effects the respiratory movement?
7. What in the male and in the female?
8. What do they average per minute in adult life?
9. What diminish and what increase these movements?
10. What are the tubular and vesicular sounds?
11. What is the breathing volume of air that passes in and out of the lungs at each inspiration and expiration?
12. What is the vital capacity of the lungs after the deepest inspiration?

13. How far is the breathing volume of air carried by the inspiratory movements?
14. How does it reach the deeper portions of the lungs?
15. What also assist the interchange of the air and carbonic acid?
16. How many cubic feet of air is it estimated, pass in and out of the thorax in 24 hours?
17. How many cubic feet of oxygen are drawn out of the air and consumed by the body in 24 hours?
18. How many of carbonic acid, and what increase and diminish the supply?
19. How is oxygen absorbed from the lungs into the arterial blood?
20. How is carbonic acid arising in the tissues absorbed into the blood?
21. How is carbonic acid liberated?
22. How much watery vapor is thrown off from the lungs daily?
23. What causes asphyxia?
24. What is the cause of death?

#### THE VOICE.

1. Name the organs of the voice.
2. Name the nine muscles which have a direct action upon the movements of the vocal cords.
3. Describe the movements of the vocal cords.
4. How are the different tones of the voice produced?
5. What is speech, and how are vocal sounds formed?
6. What are sounds; what are consonant sounds?

7

7. What are varieties of voices, and what are they due to?

### TEMPERATURE.

1. What is animal heat due to?
2. Name the conditions which cause variations in the normal temperature of the body.
3. Why does the temperature vary in different portions of the body?
4. Name the heat-producing tissues.
5. Of the entire quantity of heat generated in the body, how much is utilized?
6. How is the heat of the body lost?
7. How does the nervous system influence the heat of a part?
8. Are there special heat centres?

### SECRETION AND EXCRETION.

1. Describe the process of secretion.
2. What is the essential apparatus of secretion?
3. Secreting organs may be of what two classes?
4. What are the elements of secreting membranes and glands?
5. What is the secretion of mucous membranes called?
6. Describe mucus, also its chemical composition.
7. Name the different varieties.
8. What membranes are the serous fluids secreted from?
9. What is the nature of serous fluids, also their function?
10. What is the synovial fluid?

11. What peculiarity have the secreting glands?
12. What are they composed of and enveloped by?
13. What are the two different processes concerned in the production of the secretions?
14. How do the nervous centres in the medulla oblongata influence secretion?
15. What is the source of the materials which form the secretions?
16. Name the principal permanent and transitory secretions.
17. Describe the mammary glands and the changes they undergo.
18. Describe milk, and give the quantity secreted by the human female in 24 hours.
19. What influences modify the milk secretion?
20. Describe the mechanism of milk secretion.
21. What is casein? what is colostrum?
22. What is the function of the spleen?
23. What are the functions of the supra-renal capsules, the thyroïd gland and the thymus gland?
24. Name the principal fluids discharged from the body.
25. What does the urinary apparatus consist of?
26. Describe the passage of the urine from its excretion by the kidneys to the bladder.
27. How is the act of micturition accomplished? and what nerve centre controls the movement?
28. The source and composition of urine.
29. What is urea and where is it formed?
30. What are the amounts of urea, and of uric or lithic acid excreted daily?

31. Describe the secretion of bile; is it a secretion or an excretion?
32. What is glycogen; and its function?
33. Describe the excretion of the skin, and its appendages; composition of perspiration, its functions?

### THE NERVOUS SYSTEM.

1. What structures does the nervous system include?
2. Of what two kinds of matter is the nervous system composed?
3. The structures and functions of the nerve fibres and the gray cells.
4. How is pain transferred?
5. Into what three general classes are the nerves divided?
6. When the posterior root of a nerve is cut what sensation is lost? when the anterior root is cut, what?
7. Give the functions of the 12 pairs of cranial nerves?
8. Describe the sympathetic system?
9. How is it that derangement of one-half of the brain may paralyze the opposite half of the body?
10. How is it that the face may be paralyzed on one side and the limbs on the other side?
11. Describe reflex action; its uses.
12. How do nerves terminate? What are ganglia? What are plexuses?
13. Of what does the cerebro-spinal system consist?
14. What is nervous tissue composed of; What is nerve force?

15. Describe motor and sensitive nerves?
16. What are afferent, and what are efferent nerves?
17. Describe the properties and influence upon the special senses of the fifth pair of nerves?
18. What is meant by the cerebro-spinal axis?
19. What is the cerebro-spinal fluid?
20. Describe the functions of the spinal cord.
21. Describe the functions of the medulla oblongata and pons varolii.
22. Describe the functions of the crura cerebri, the corpora quadrigemina and the corpora striata, and optic thalami.
23. Describe the functions of the cerebellum, and cerebrum.

### THE SPECIAL SENSES.

1. Describe the sensation of touch, and in what is it located.
2. Why does tactile sensibility vary in acuteness in different parts of the body?
3. Why does the cutaneous surface vary in its sensibility to temperature in different parts of the body?
4. How are sensations of pain and tickling conducted to the brain?
5. Where is the sense of taste located?
6. What are the taste beakers?
7. Describe the nerves of taste.
8. What are the essential conditions for the production of the impression of taste?
9. Where is the sense of smell located?
10. Describe the olfactory nerves and bulbs.

11. What are the essential conditions of the sense of smell?
12. Where is the sense of sight situated?
13. What are the essential conditions for proper vision?
14. Describe the refractory apparatus.
15. What is the action of the iris?
16. What membrane receives the impressions of light?
17. What is the point of most distinct vision?
18. Describe the course of a ray of light entering the eye.
19. How is the accommodation of the eye to vision for different distances accomplished?
20. Describe optical defects.
21. Name the accessory structures of the eye.
22. What secretes the tears, and their use?
23. Where is the sense of hearing located?
24. How is sound heard, and what is the course of the waves of sound entering the external ear?

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## CHEMISTRY.

1. What does the science of Chemistry investigate?
  - a. Into what two parts is it divided?
  - b. What does organic chemistry treat of?
  - c. What does inorganic chemistry treat of?
2. Into what are all substances chemically divided?
  - a. Describe each division.
3. Describe a base? a salt? an acid? an alkali? an alkaloid? also the terms dialysis, colloid, and crystalloid?

4. What is an anhydride, and what relation does it bear to an acid ?  
a. Give an example.
5. What is meant by a chemical equation ?
6. Examine the following equations, and if there are any errors correct them :
  - a.  $\text{Ca CO}_3 = \text{Ca O} + \text{CO}$ .
  - b.  $\text{Na OH} + \text{HCl} = \text{Na Cl} + \text{H}_2\text{O}$ .
  - c.  $\text{Fe} + 2\text{HCl} = \text{Fe Cl} + \text{H}$ .
  - d.  $2 \text{Na Cl} + \text{H}_2\text{SO}_4 = \text{Na}_2\text{SO}_4 + \text{HCl}$ .
7. What is meant by chemical action ?
8. What is the difference between a chemical element and a compound ?
9. What is meant by atomic weight ? what is meant by molecular weight ?
10. Explain what is meant by calling chlorine a monad, oxygen a dyad, nitrogen a triad, and carbon a tetrad ?
11. Explain with examples, the difference between atomic and molecular formulae ?
12. Give the density of any body volatile without decomposition ?
  - a. How can its molecular weight be found ?
13. What is an atom ; a molecule ?

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## INORGANIC CHEMISTRY.

### *Oxygen and Hydrogen.*

1. Describe the preparation and the leading properties of oxygen.
  - a. What is the density of liquid oxygen identical with ?
2. Describe the action produced by animals, and by plants on the air.

3. What is the composition of the atmosphere?
  - a. Explain the purpose served by each of the constituents.
4. What is meant by the combining weights of the elements?
  - a. Give an example.
5. What is the composition and what are the properties of ozone?
6. Explain the construction and operation of the barometer.
7. Describe the methods of preparation and the leading properties of hydrogen.
8. What is formed when hydrogen burns in the air?

*Chemical Calculations.*

1. Describe briefly the metrical system of weights and measures.
2. How is a thermometer made and graduated?
3. Describe the three thermometric scales now in use.
4. What simple method is used for calculating the weight of one liter of the elementary gases at the standard temperature and pressure?
5. State the laws of gaseous diffusion.

*Water.*

1. Describe the most exact methods of determining the composition of water by volume, and also by weight.
2. What is meant by the latent heat of water?
  - a. How can this be determined?
3. Describe the changes in bulk which water undergoes when heated from  $0^{\circ}$  to  $100^{\circ}$ .

4. When does water boil?
5. How is the latent heat of steam determined?
6. How can water be frozen by its own evaporation?
7. How is the tension of aqueous vapor measured?
8. Why must the barometric pressure be noticed when graduating a thermometer?
9. How is pure water obtained?
10. What is the composition and chief properties of hydrogen dioxide?

*Nitrogen. The Atmosphere.*

1. Describe the method of preparation and the leading properties of pure nitrogen gas.
2. What is the mean height of the barometer at the sea's level?
3. Why does water boil at a lower temperature than 100° on the top of a mountain?
4. What reason is there for believing that the air is a mechanical mixture, and not a chemical combination of nitrogen and oxygen?
5. How may the composition of the air be determined by weight as regards nitrogen and oxygen?
6. What important part does carbonic acid act as regards vegetation?
7. How is rain formed?
8. Explain how dew and hoar frost are formed.
9. Name other constituents of the atmosphere.

*Nitric Acid and Oxides of Nitrogen and Ammonia.*

1. Give the composition by weight of the five oxides of nitrogen?
2. What is meant by chemical combination in multiple proportions?

3. What are the principles of Dalton's atomic theory?
4. What relation exists between the densities of elements in the gaseous state and their atomic weights?
5. Write out in symbols the decomposition occurring in the preparations of nitric acid, and explain the meaning of these symbols.
6. Give the tests for nitric acid.
7. Name the chief properties of nitrous oxide gas.
8. How many grams of nitrogen monoxide and water can be obtained from 213 grams of ammonium nitrate?
9. How is the composition by volume of nitrous oxide gas determined?
10. Describe the relation between nitrogen pentoxide and the nitrates trioxide and the nitrites.
11. How is nitric oxide or nitrogen dioxide prepared?
12. Describe the difference between nitrous oxide and nitric oxide.
13. Give the formulae representing the two different methods by which ammonia can be prepared.
14. Describe the properties of ammoniacal gas.
15. How is ammonia frozen?
16. How can the composition by volume of ammonia be ascertained?
17. How is liquid nitrous oxide prepared?

*Carbon.*

1. Name the three distinct forms in which carbon exists.
  - a. State their chief peculiarities.

2. Carbon combining with oxygen, hydrogen and nitrogen, forms compounds which are considered as forming what separate branch of chemistry ?
3. Describe the nature of the diamond.
4. Describe the nature of graphite or plumbago.
  - a. What changes have occurred in the passage of wood into charcoal ?
5. Describe the nature of coal, its source and composition.
6. How many compounds does carbon form with oxygen, and what are they ?
7. Give the preparation of carbonic acid or carbon dioxide, and its properties.
  - a. What law regulates the absorption of this gas in water ?
  - b. How can carbonic acid be obtained in the liquid and in the solid state ?
  - c. What peculiar properties does the liquid exhibit ?
  - d. What is the mode adopted for obtaining very low temperatures by means of carbonic acid ?
8. Give the preparation and properties of carbonic oxide gas or carbon monoxide.
  - a. What is formed when caustic potash and carbonic oxide gas are heated together ?
  - b. How is the composition of carbonic oxide gas ascertained by eudiometric analysis ?
9. In what forms are the compounds of carbon with hydrogen known ?
10. What is the composition of marsh-gas and fire-damp ?

11. How is acetylene formed, and what are its properties?
12. How is ethene, heavy carburetted hydrogen, or olefiant gas formed, and what are its properties?
13. State briefly the properties and composition of coal-gas.
  - a. How is the illuminating power of coal-gas ascertained?
14. Describe the structure of flame.
15. Describe the construction of a Bunsen's burner.
16. Explain the principles of the Davy lamp.
17. What is cyanogen compound?
  - a. What is the most important compound formed by cyanogen with hydrogen?
  - b. How is cyanogen gas prepared, and what are its properties?

*Chlorine.*

1. Give the preparation and properties of chlorine.
2. Chlorine by combining with hydrogen forms what acid?
3. Upon what does the bleaching action of chlorine depend?
  - a. Does dry chlorine gas bleach?
  - b. What is the composition of bleaching powder?
4. How is chlorine gas generated, and what are its properties?
5. Describe experiments showing the power of chlorine to combine with hydrogen.

6. How is the composition of hydrochloric acid determined?
7. Give the formulae of the oxides of chlorine and the corresponding acids.
8. Describe the action of water upon chlorine monoxide, nitrogen pentoxide, and carbon dioxide.
9. Describe the preparation and properties of hydrochloric acid gas.
10. Give the preparation and properties of aqua regia?
11. Do chlorine and oxygen unite directly? can they be made to unite indirectly?
12. What is hydrochlorous acid?
13. How is chlorine trioxide produced?
14. How is chlorine tetroxide obtained and what are its properties?
15. What is chloric acid or hydrogen chlorate?
16. What is perchloric acid?
17. How is potassium chlorate prepared?

*Bromine.*

1. Describe the process of obtaining pure bromine.
  - a. What are its properties?
2. What is the composition of bromine and perbromic acids?
3. What are the oxides and oxy-acids of bromine analogous to?
4. What is hypobromous acid?
  - a. To what is its power of bleaching vegetable coloring matters due?

*Iodine.*

1. How is iodine obtained and what are its leading properties?
2. Give in an equation the decomposition occurring in the manufacture of iodine from potassium iodide?
3. How is hydriodic acid gas prepared and what are its properties?
4. When iodine is treated with caustic alkaline solutions what two important acids are formed?
5. How may iodine, bromine, and chlorine, when present in solution together be detected?

*Fluorine.*

1. Give the source of fluorine and its properties.
  - a. Is it ever found in the teeth and blood of animals?
  - b. Is it difficult to prepare in a pure state?
  - c. Does it form any compounds with oxygen?
2. What are the general relations which chlorine, bromine, iodine and fluorine exhibit among themselves?

*Sulphur.*

1. Give the source of sulphur and some of its chief properties.
  - a. State the different compounds in which sulphur is met with in nature.
2. Write the names and symbols of the compounds of sulphur, oxygen, and hydrogen.
3. How is sulphur dioxide, or sulphurous anhydride prepared, and what are the properties of this gas?

4. Sulphurous acid is the hydrogen salt of a series of compounds known by what names?
5. How does the bleaching action of sulphurous acid differ from that of chlorine?
6. In what respect are sulphurous and carbonic acids similar?
7. Under what circumstances does sulphur dioxide combine with oxygen?
8. How is real sulphurous acid formed from sulphur dioxide?
  - a. What is the constitution of the salts termed sulphites?
9. How is sulphuric acid prepared, and what are its properties?
10. Describe the decomposition by which sulphuric acid is prepared in the leaden chamber?
11. How may the presence of sulphuric acid be detected?
12. How is thiosulphuric acid obtained?
13. How is hyposulphurous acid formed, and what are its properties?
14. What are the principal compounds of sulphur, hydrogen and oxygen?
15. How is sulphuretted hydrogen or hydrogen sulphide formed, and what are its properties?
  - a. How may this gas be used for the separation of the metals into groups?
16. Describe the relations existing between the oxygen and sulphur compounds.

*Selenium, Tellurium, Silicon, Boron.*

1. What is selenium and what element does it closely resemble in its properties?
  - a. How is selenium dioxide formed?

2. What is tellurium, and what does it resemble in its physical properties ?
3. What is silicon, and what are its chief properties ?
4. What is the source of boron, and by what name is it known when combined with oxygen and sodium in nature ?
5. How is crystallized boron prepared, and what are its properties ?
6. Where does boracic or boric acid occur ?
  - a. How may it be obtained from borax ?

*Phosphorus.*

1. With what is phosphorus found in combination ?
2. How may phosphorus be prepared from bone ash, and what are its chief properties ?
3. Whence do animals ultimately get the phosphorus which they need ?
4. Describe the different modifications of phosphorus ?
5. How is phosphoric acid prepared ?
6. Give the formulae of the tribasic sodium phosphates ?
7. What two chlorides of phosphorus are known, and how are they prepared ?
8. What is hypophosphoric acid ?

*Arsenic.*

1. What does arsenic closely resemble in its chemical properties, and also in those of its compounds ?
2. How is arsenic separated from its ores, and what are its leading properties ?

3. What are the peculiar characteristics of the arsenites and the arsenates?
4. How does ferric oxide act as an antidote in arsenical poisoning?
5. Describe the tests by which arsenic can be detected with certainty.
6. What is the composition and preparation of arseniuretted hydrogen?
7. Describe the general chemical relations of the arsenic, phosphorus, and nitrogen compounds.

*Chemical Properties of the Metals.*

1. At what temperatures does mercury boil and freeze?
2. Describe the modes in which the metallic ores generally occur?
3. Give some of the peculiar properties of the alloys?
4. Describe hydrogenium?
5. What are metallic oxides?
6. What is meant by a metallic salt?
7. Describe the relations existing between the atomic heats and combining weights of the elements.
8. Give the law regulating the atomic heat of compounds?

*Metals of the Alkalies.*

1. How is potassium prepared, and what are its chief properties?
2. Name the sources of the potassium compounds?
3. Potassium combines with oxygen in what two proportions?

4. How is caustic potash obtained ?
5. How is potassium carbonate prepared, and what are its chemical properties ?
6. How is potassium nitrate prepared and what are its chemical properties ?
  - a. What is gunpowder, and what happens when it is burnt ?
7. Name the characteristic tests for potassium salts ?
8. How is potassium iodide prepared, and what are its chemical properties ?
9. What are the sources of the sodium compounds ?
10. Describe the salt-cake process.
11. Describe the decomposition by which salt-cake is converted into soda-ash.
12. What is the analogy in constitution existing between potassium and ammonium salts ?
13. Describe the source and chemical properties of lithium ? Is it lighter than aluminium ?
14. How is ammonium chloride, or sal-ammoniac obtained ?
15. What is lime, how is it made ?
  - a. What is lime-water, and what are its properties ?
16. What is the composition of slaked lime ?
17. How can temporarily hard water be softened ?
18. Name the commonest minerals containing barium and strontium ?
19. How can oxygen gas be prepared from barium dioxide ?
20. What are the distinguishing reactions of the compounds, calcium, strontium and barium ?

21. Give a brief account of the composition and properties of the different kinds of glass.
  - a. How are colored glasses obtained ?
  - b. How is common earthenware glazed ?
22. How can the magnesium salts be distinguished and separated from those of calcium ?
23. Give the composition of the several manganese oxides.
24. What are the tests to detect the presence of the compounds of zinc, cadmium and manganese ?
25. What are the important chemical properties of iron ?
26. How is ferrous sulphate obtained ?
27. What is the composition of red haematite and specular iron ore ?
28. How can ferrous and ferric salts be distinguished ?
29. What chemical changes take place in refining and puddling iron ?
30. What is the cause of difference in appearance and properties of mottled and white cast-iron ?
31. Name some of the chemical characteristics of aluminium, zinc, beryllium, magnesium, cadmium, manganese, cobalt, nickel, tin, titanium, chromium, molybdenum, tungsten, uranium, antimony, bismuth, vanadium, lead, thalium, copper, mercury, silver, gold and platinum.
32. How can cobalt and nickel be distinguished by the blow-pipe ?
33. How can tin compounds be distinguished ?
34. Give the formulae of the potassium chromates.
35. Give the formulae of the corresponding oxides of arsenic and antimony.

36. What are the chief distinguishing properties of the bismuth compounds?
37. State the decompositions which occur in the process of lead-smelting.
38. Describe the action of lead upon water.
39. What is white-lead?
40. How is copper obtained from copper pyrites?
41. Give the percentage of water in crystallized copper sulphate?
42. What is the density of mercury vapor? Is it in accordance with the usual law of densities?
43. Give the tests which distinguish copper, mercury, silver and gold?

*Spectrum Analysis.*

1. What is the phenomena observed when a source of white light is observed by means of a prism?
2. Describe the peculiarity observed in the spectra of colored flames.
3. How does the spectrum of a glowing solid differ from that of a glowing gas?
4. How can the spectra of metals be obtained?
5. Describe the contraction and use of the spectroscope.

**ORGANIC CHEMISTRY.**

1. In what respect do organic substances differ from inorganic?
  - a. Give an example of an organized structure.
  - b. What is the simple cell the germ of?
  - c. Can it be artificially prepared from its elementary constituents?

2. State the two chief peculiarities of the carbon compounds.
3. Give examples of monad, dyad, triad and tetrad elements.
4. What is meant by saturated and non-saturated carbon compounds?
5. Give the chlorine substitution products of marsh gas.
6. What is the constitution of the hydrides, chlorides and alcohols of the first three series of carbon compounds?
7. Show that the constitution of the saturated compound benzol,  $C_6H_6$ , is different from the alcohol group of bodies.
8. Give example to show the distinction between empirical and rational formulae.

*Organic Analysis.*

1. Describe briefly the process for the estimation of the carbon and hydrogen contained in organic compounds.
2. What is the molecular weight of an acid (monochloracetic,) whose silver salt contains 536 per cent. of this metal?
3. How does the determination of the vapor density of an organic body, serve as a means of ascertaining its molecular weight?
4. What is the density of ammonia, marsh gas, olefiant gas, methyl alcohol, ethyl alcohol?
5. Describe two methods employed for determination of vapor density.

*Cyanogen, Carbonyl and Sulpho-Carbonyl Compounds  
and Paraffin Group.*

1. How can hydrocyanic acid be directly obtained from inorganic sources ?
2. Give the formulae for cyanuric acid, diethyl urea, sulphocyanic acid and cyanamide.
3. How can the paraffins be obtained artificially ?
  - a. Give the names and formulae of the principal members of the series.
4. How can the existence of several isomeric paraffins be explained ?

*Monatomic Alcohol-Group.*

1. What is the analogy in constitution existing between the ethyl and potassium compounds ?
2. Give the formulae for ethyl alcohol, ether, acetyl, acetate, aldehyde, acetamide.
3. Give the names of the following:
 
$$\text{N}(\text{C}_2\text{H}_5)_4 \left\{ \begin{matrix} \text{C}_2\text{H}_5\text{O} \\ \text{O} \\ \text{C}_2\text{H}_5\text{O} \end{matrix} \right\} \text{N}(\text{C}_2\text{H}_5)_3 \left\{ \begin{matrix} \text{C}_2\text{H}_5 \\ \text{C}_2\text{H}_5 \\ \text{C}_2\text{H}_5 \end{matrix} \right\} \text{P.}$$
4. What is the chemical change which occurs in the passage from a primary alcohol to the corresponding acid ?
5. Write a list of the first five primary alcohols with their derived acids ?
6. How is a secondary alcohol distinguished from the isomeric primary one ?
7. Explain the construction of dimethyl carbinol and trimethyl alcohol ?

8. Name the properties and preparation of methyl alcohol ?
9. What is the action of sulphuric acid upon methyl alcohol ?
10. By what reactions can we pass from the methyl to the ethyl series ?
11. What is the difference between methyl cyanide and acetonitrile ?

*Dicarbon or Ethyl Series, and Higher Carbon Series.*

1. How can alcohol be prepared from its inorganic materials ?
2. Give the formulae for potassium ethylate, potassium ethyl-sulphate, and ether ?
3. Give in formulae the decomposition by which propionitrile yields propionic acid ?
4. Give the formulae of primary propyl alcohol, propionic acid, propyl chloride, butyl alcohol ?
5. Give the formulae of the three possible isomeric hydrides containing 5 atoms of carbon ?
6. How can the higher alcohols be prepared from petroleum ?

*Compounds of the Alcoholic Radicals with the Nitrogen Group of Elements.*

1. Mention the reaction by which the compound alcoholic ammonias can be prepared ?
2. Give the percentage of platinum in  $2(N(O_2H_5)_3HCl) + PtCl_4$  ?
3. How can the constitution of a compound ammonia of the composition  $C_5H_9N$  be determined ?

4. Describe the composition, properties and preparation of the phosphorus bases ? the arsenic bases ? the antimony bases ?
5. How is zinc ethyl prepared, and what are its chief properties ?

*Compounds derived by Oxidation from the Alcohols.*

1. State the chief reactions by which the fatty acids can be formed ?
2. How can acet-aldehyde be produced from acetic acid ?
  - a. How can aldehyde be reduced to alcohol ?
  3. What is meant by acetous fermentation ?
  4. Name some of the chlorine substitution-products of acetic acid ?
  5. Give the formulae and preparation of acetic acid, acetyl peroxide, acetamide, acetone, acetylene ?

*Distomie Alcohols.*

1. How are the acids of the lactic and oxalic series derived from the corresponding glycols ?
2. How can oxalic acid be obtained from carbon, oxygen and sodium ?
3. Describe the manufactures of oxalic acid from saw-dust.
4. In what important respect as regards the formation of salts, do lactic acid and its homologues differ from oxalic acid and the higher terms of its series ?
5. How can malic and tartaric acids be obtained from succinic acid ?

6. What is the action of hydriodic acid upon tartaric acid ?

*Trivalent Alcohols and their Derivatives.*

1. Describe the process of saponification.
2. Give the formulae of the composition of chlorhydrines ?
3. What is the constitution of mannite; and what reasons are there for supposing it to be hexatomic alcohol ?

*Carbo-Hydrates, Sugars and Glucose.*

1. Describe briefly the preparation and refining of sucrone, or cane sugar ?
2. Give the formulae of sucroses and glucoses ?
3. What is meant by right and left hand rotary power ?
4. What is the action of yeast and dilute sulphuric acid upon cane sugar ?
5. Describe lactose ? what acids does it form when oxidized ?
6. How is dextrose prepared ? describe it ?
7. What is levulose, and how is it obtained ?
8. Describe briefly the principal phenomena of fermentation.
  - a. What does alcoholic fermentation produce ?
  - b. What does acetous produce ?
  - c. What does lactic chiefly yield ?
  - d. What does butyric chiefly yield ?
  - e. What does mucous give rise to ?

*Starch, Gum, and Glucocides.*

1. How does starch differ in constitution from glucose?
2. What is the composition of gun-cotton, and what are its advantages over gunpowder?
3. State some of the general characteristics of a glucocide?
4. What are the three most important glucocides?
  - a. Give the chemical characteristics of amygdalin, salicin and tannin?

*Group of Aromatic Compounds.*

1. Give the chemical characteristics of benzol, phenol, thymol?
  - a. How are the carbon atoms of benzol arranged?
2. What substances are formed by the replacement of one atom of hydrogen in benzol by  $\text{N O}_2$ ,  $\text{N H}_2$ , and  $\text{OH}$ ?
3. Describe the preparation of aniline.
4. How is rosaniline prepared?
5. How can the oil of bitter almonds be converted into benzoic acid, and benzoic acid into oil of bitter almonds?
6. What is the composition of oil of wintergreen?
7. How can salicylic acid be obtained from phenol?
8. What is the chief coloring matter of madder?
  - a. How can it be artificially prepared?
9. Describe naphthalene? also anthracene?

*Turpentine and Camphor—Vegeto-Alkaloids.*

1. What is meant by physical isomerism?
2. What is the general composition of essential oils?
3. What is the constitution of oil of turpentine?
  - a. What is the action of iodine on turpentine?
  - b. What essential oils are isomerides of turpentine?
4. Describe camphor, and what it dissolves in unaltered?
5. What are such resins and balsams as mastic, copal, benzoin, &c.?
6. Caoutchouc and gutta percha are compounds of what?
  - a. Caoutchouc combined with sulphur forms what?
  - b. Gutta percha is soluble in what solutions?
  - c. What effect has alcohol upon gutta percha?
7. What are the vegeto-alkaloids?
8. Describe the alkaloids of opium? what name is given to the opium alkaloids?
  - a. How are morphine, apomorphine, and codeine related?
9. What is the constitution of narcotine, of thebaine, of papaverine, brucine, strychnine?
10. What are the tests for the presence of morphine, brucine, and strychnine?
11. State the chief properties of quinine, cinchonine, and their isomers?

*Albuminous Substances.*

1. In what chemical characters do the albuminous bodies differ from definite chemical compounds?
2. From what does the animal derive its supplies of albuminous substances which constitute the greater part of the solids of its body?
3. What is the constitution of albumin, fibrin, casein?
  - a. How may they be separated?
4. Describe globulin, myosin, glutin, gelatin?

*Animal Chemistry.*

1. Describe the composition and chemical constitution of the bones of animals?
2. Describe the composition and properties of blood, milk, and bile.
3. What is haemoglobin, and what does it form with oxygen.
4. How are oxygen, carbonic acid, and nitrogen contained in blood?
5. Describe the composition and properties of the urine?
6. What is the difference between animal and vegetable life?
7. From what source do animals obtain the energy necessary for existence?
8. From what source do plants obtain their energy?
9. What are the four classes of substances serving as material to build up the structure of animals?
10. Describe the general characteristics of the farinaceous and saccharine, the fatty, the nitrogenous, and the mineral substances.

11. What are the characteristics of vitellin, ossein, gelatin, chondrin?
12. What are the characteristics of the saliva?
  - a. What is the chemical composition of ptyalin?
  - b. What of salivary calculus?
13. What are the characteristics of the gastric juice?
  - a. What is its chemical composition?
  - b. What are peptones?
14. Describe cholesterolin.
15. Describe the action of the bile on food.
16. Describe the pancreatic juice, and its action?
17. Describe the intestinal fluids and gases.
18. Give the composition of human lymph and chyle.
19. Describe the characteristics of serum.
  - a. Describe the coagulation of the blood.
  - b. Describe the red globules and white corpuscles.
  - c. What is haematin?
20. To what does the coloring matter of the blood owe its color mainly?
21. What is the difference between arterial and venous blood?
22. Describe the chemical pathology of the blood.
23. Describe the chemical theory of respiration.
24. What two different changes does the food carried by the blood into the various organs undergo?
25. Describe the sources of animal heat and muscular power?
26. Describe the transformation of albuminoid substances in the body.

27. Describe the transformation of amylaceous or farinaceous food.
28. What is glycogene, and how is its transformation into sugar effected?
29. Describe the transformation of fatty substances.
30. What are the characteristics of urea?
31. Give the analysis of urinary calculus?
32. What are the characteristics of sweat and semen?
33. What of the mucus fluids?
  - a. What is mucin?
34. What is the composition of flesh?
35. Describe cells, the simplest structures of the body.
  - a. What is the protoplasm of cells?
36. What are the chemical characteristics of areolar tissue?
37. What of cartilaginous and nerve tissues?
  - a. What are the constituents of the brain?
38. Describe the chemistry of the eye.
39. Describe the chemistry of the tooth structures, enamel, dentine and cementum?
40. Describe the chemical characteristics of pus.

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## METALLURGY.

1. How many elements are known at present, and how many of them are metals?
2. Name the 14 metals, with their symbols and atomic or combining weights, that are employed in true metallic condition.

3. Name the 12 metals, with their symbols and atomic or combining weights that are used more or less in medicine, in the arts as coloring pigments, and for forming alloys.
4. Name the seven metals that are concerned in the maintainance of animal and vegetable life, and give the symbols and combining weights of those not already referred to.
5. Why are some metals called noble and others base?
6. Name the noble and also the base metals.

### PROPERTIES OF METALS.

1. Define a metal.
2. Describe the general properties of the metals, such as color, opacity, lustre, fusibility, odor and taste.
3. Give the fusing points of
 

Gold,	Potassium,	Rhodium,
Silver,	Sodium,	Osmium,
Copper,	Antimony,	Tantalum,
Lead,	Cast Iron,	Tungsten,
Zinc,	Cobalt,	Tellurum,
Bismuth,	Iridium,	Thorium,
Mercury,	Manganese,	Rubidium,
Platinum,	Palladium,	Arsenic,
Tin,	Titanium,	Cerium,
Cadmium,	Lithium,	Uranium,
Chromium,	Molybdenum.	
4. Describe the capacity of metals for heat.
5. Describe the property of expansion by heat.
6. Describe the power of conducting electricity.

- a. Taking 100 as the maximum at 32° F. give the conducting property of silver, copper, gold, zinc, iron, tin, lead, antimony, bismuth.
7. Describe the qualities of malleability, ductility and tenacity in metals.
  - a. Give the order of malleability of the different metals employed in dental practice.
  - b. Give the order of ductility of the same metals.
  - c. Give the order of tenacity of the same metals.
8. Define the crystallization of metals.
9. How may elasticity and sonorousness be conferred upon metals?
10. Define the volatility of metals. Name the agents capable of volatilizing metals.
11. What general characteristics distinguish the metals from the non-metals?
12. What is understood by the terms atom, molecule and atomic weight?
13. What is meant by a native metal? and what metals occur in this condition?
14. What is meant by the specific gravity of a solid, such as gold for example, and how may the specific gravity of a piece of gold be determined?
15. What is understood by the reduction of an ore of a metal? Give an example.

#### ALLOYS.

1. Define an alloy.
  - a. What is the difference between an alloy and an amalgam?

2. Describe the general properties of alloys.
3. What is the density of alloys, of gold and silver; tin and silver; tin, silver and copper; silver, tin and zinc; bismuth and lead; copper and zinc; copper and palladium; zinc and antimony?
4. What is the effect as to color of alloying metals?
5. What as to malleability, ductility and tenacity?
6. What as to fusibility?
7. Give the composition of the coinage of gold, coinage of silver, of brass, of German silver, of type metal, of English metal, of Babbitt metal, of pewter, of Britannia metal, of plumbers' solder,—the average proportions.
8. By what process is the base metal of an alloy, which also contains a noble metal, converted into an oxide?
9. What property does bismuth, tin, cadmium, and mercury give to alloys into which they enter?
10. What property does lead and iron give?
11. What property does arsenic and antimony?
12. Define liquation as applied to metals.
13. Define temper as applied to metals.
14. Describe the preparation of an alloy composed of a noble and one or more base metals.
15. How are solders composed of gold or silver, to which brass, etc. is added for the purpose of lowering the fusing point, made?
16. What is the action of acids upon alloys compared with that on a simple metal?
17. What effect have heat and air upon alloys consisting of two metals, one readily oxidizable, and the other possessing less affinity for oxygen?

18. Explain the increased affinity for oxygen which is shown by alloys.

### AMALGAMS.

1. Define an amalgam. In what respects do amalgams and alloys resemble, and in what differ from chemical compounds?
2. How are amalgams formed?
3. Does the evolution of heat ever attend the formation of an amalgam?
  - a. If so, give an example?
  - b. Is an electric current ever developed?
4. Describe the properties of amalgams.
5. What qualities should an amalgam as a filling material possess?
6. Explain why old amalgam fillings sometimes appear as if projecting from the edges of the tooth cavity.
7. Upon the formation of what does the discoloration of dental amalgams depend?
8. Has sulphur much affinity for silver and mercury?
9. Will some of the metals of a dental amalgam which do not possess an affinity for sulphur, protect others in the same amalgam which have?
10. What does the darkening of the tooth substance in contact with an amalgam filling indicate?
11. Does it invariably happen that an amalgam filling which retains its original color and luster will preserve the teeth?
12. Does it also follow that an amalgam filling that presents surface-discoloration will fail to protect the tooth?

13. Describe the influence of mercury on tin.
  - a. Of mercury on silver.
  - b. Of mercury on gold.
  - c. Of mercury on platinum.
14. When tin is mixed with other metals in an amalgam, what effect has it upon the process of amalgamation?
15. In what state should pure silver filings be, in order to facilitate their prompt and complete solution? What should be the condition of the mercury?
16. Is a silver and tin amalgam more readily oxidized than either of the constituents?
17. What is the direct influence which silver exerts upon an amalgam of tin and mercury?
  - a. Is its action in this respect similar to that of gold?
18. Does gold combine with mercury at all temperatures?
  - a. What state should the gold be in, to ensure a rapid amalgamation?
  - b. Does an amalgam of gold and mercury alone harden well?
  - c. What is the effect of tin added to such an amalgam?
19. Does platinum in the form of plate or wire readily unite with mercury?
20. What effect does platinum have when added to an amalgam of tin, silver and mercury?
  - a. What effect when added to an amalgam of gold, tin and mercury?
  - b. What is the effect of platinum in the amalgamation of other alloys?

21. In the formation of an amalgam why is it necessary that the requisite amount of mercury only should be used?
  - a. How may this be determined?
  - b. Should the mercury used be reduced to the minimum? and what is the effect of this upon the working of the amalgam?
  - c. After an amalgam has once hardened, should any attempt be made to restore its plasticity by the addition of more mercury?
22. What is the effect as to brittleness of platinum in an amalgam?
  - a. As an example, take of silver 40 grains, tin 60 grains, now, how much gold and how much platinum should be added to make a "strong-edge" amalgam?
23. What is the effect of oxidation of the surface from contact with the atmosphere on amalgamation?
24. What are the effects of copper as a constituent of an amalgam? What kind of an amalgam does palladium and mercury make?
25. Describe the process of combining the metals by fusion in making an amalgam.
  - a. What metals should be fused first?
  - b. What will prevent the oxidation of the mass of metals in the crucible?
  - c. What effect has powdered borax applied to the crucible before fusing?
26. Describe the process of obtaining a quantitative analysis of an old amalgam filling?
27. Describe the process of obtaining a qualitative analysis of an old amalgam filling.

28. Name the metals used in making alloys for amalgamation with mercury as filling material.

### MELTING METALS.

1. Describe a suitable furnace and other apparatus for melting metals in the dental laboratory ?
  - a. What is the advantage of gas as an agent for melting metals ?
  - b. Describe the mouth and self-acting blow-pipes.
  - c. What is a crucible, and of what materials are crucibles constructed ?
  - d. Describe the preparation of the crucible before using it ?
  - e. Describe ingot molds, rollers, gauge plates, drawplates ?
2. Describe the process of soldering ?
  - a. The preparation of the surfaces to be united ?
  - b. Name the conditions of successful soldering ?
3. What requisites should a solder possess ?
4. Describe the preparation of an artificial denture for soldering ?
5. Describe the application and management of the heat ?
6. Describe the supports for soldering purposes ?

### COMBINATIONS OF METALS WITH NON-METALLIC ELEMENTS.

1. How are chlorides of metals formed ?
2. How are metallic oxides formed ?

3. How are metallic bromides, iodides, fluorides, and sulphides formed ?
4. How may superficial oxidation occur ?
5. What metals form metallic oxides during fusion ?
6. What noble metals possess so little affinity for oxygen that they cannot be made to combine directly with it, and even when their oxides are obtained chemically these metals separate from the oxygen when heated to redness ?
7. Describe the term reduction when used in metallurgy ?
8. How are the chlorides of gold and platinum decomposed ?
9. What effect has sulphuric acid upon the chlorides ?
10. How may the reduction of the sulphide of gold, silver, and platinum be effected ?
11. How may the reduction of lead, tin, and zinc which have been injured by repeated meltings be effected ?
12. Describe the process of electrolysis ?

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## METALS EMPLOYED IN DENTAL PRACTICE.

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### GOLD.

1. Give the symbol and atomic weight of gold ?
2. Describe the source, also the forms in which gold is found, and its nature.
  - a. Its native rock or bed ?

- b. Is it always found in the metallic state?
    - c. Is it ever found in crystals?
    - d. The gold of what country contains the most silver? what the most copper? what the most iron?
  - e. What is the invariable alloy of native gold?
  - f. What other metals are often found associated with gold?
  - g. What glittering particles are often mistaken for gold, and how test them?
  - h. What ore is invariably gold-bearing?
  - i. Is a native gold amalgam ever found, and where?
- 3. Describe the properties of gold?
  - a. What is the color and density of pure gold?
  - b. Is pure gold too soft for artificial dentures?
  - c. How does the weight of gold compare with that of other metals?
  - d. What properties especially distinguish gold?
  - e. What is its property of tenacity, and how may this be increased?
  - f. Is gold capable of being welded while cold?
  - g. What is its rank as a conductor of heat?
  - h. What as a conductor of electricity?
- 4. What is the specific gravity of gold?
- 5. What is its fusing point?
- 6. How is coarse gold obtained from alluvial deposits?
  - a. How is the fine dust obtained?
  - b. How is it obtained from quartz rock?
  - c. Describe the process of obtaining gold by amalgamation.

- d. What is the process for detecting the presence of gold in alloys called?
    - e. What is the process of determining the quantity of gold in alloys called?
  - 7. What will dissolve gold?
    - a. Give the proportions of the solution?
  - 8. What will precipitate gold in solution?
  - 9. Describe the processes of dissolving and precipitating gold?
  - 10. Describe the tests or reagents to determine the presence of gold in an alloy.
  - 11. What effect on gold has the slightest admixture of lead or zinc, or tin, or antimony, or arsenic?
  - 12. Describe the processes of refining gold?
  - 13. How remove all traces of lead, zinc, iron, etc. from laboratory gold scrap?
  - 14. Describe the process of making gold foil for filling teeth.
  - 15. Describe the process of making crystal or sponge gold?
  - 16. What is the difference between non-cohesive and cohesive gold foils?
  - 17. How is chemically pure gold obtained, describe the process?
  - 18. What does the term "carat" imply?
    - a. The number of carats that expresses the unity of pure gold?
    - b. Describe the decimal system.
  - 19. What is the carat value of American and of English gold coin?
  - 20. Describe the manufacture of gold plate for dentures?
    - a. How fine should such plate be?

21. Describe the manufacture of gold solder.
  - a. Give an alloy for a fine gold solder.
  - b. Give an alloy for an easy flowing gold solder.
  - c. Should gold solder be made from laboratory scrap?
22. Why cannot cast gold plates for dentures be made?
23. Describe the process of alloying pure gold with copper?
24. What alloy of gold and platinum will give a strong plate?
25. Give the rule for ascertaining the carat of an alloy of pure gold, silver and copper.
26. Give the rule for reducing gold to a required carat.
27. How reduce gold from a higher to a lower carat?
28. How raise gold from a lower to a higher carat?
29. Give the rule to determine the fineness of gold plate or gold solder made from known quantities of gold and alloy.
30. Does alloying gold with silver affect its malleability?
  - a. What is the effect of alloying gold with platinum?
31. Does gold and mercury unite at all temperatures?
  - a. What will hasten the amalgamation?
  - b. What is the effect of an admixture of iridium with gold?
32. Describe the treatment of brittle gold.

33. Name the most important alloys of gold.
  - a. Describe an alloy of gold and silver.
  - b. Describe an alloy of gold and tin.
  - c. Describe an alloy of gold and platinum.
  - d. Describe an alloy of gold and copper.
  - e. Describe an alloy of gold and palladium.
  - f. Describe an alloy of gold and zinc.
34. What is purple of Cassius, which is used to give the gum color to porcelain teeth?
35. What is the most important of the compounds of gold, and the one from which most of the preparations of gold used in the arts is obtained?
  - a. How is it prepared?
36. Name the most important tests for gold.
37. Define the process of assaying gold.
  - a. Describe the different processes of assaying.
  - b. What is the accuracy of the result of an assay liable to be influenced by?
38. How may gold be deposited upon the surface of another metal? describe the process.

#### SILVER.

1. Give the symbol and atomic weight of silver.
2. Describe the source, also the most common ores of silver, and the different forms in which it is found.
3. Describe the principal processes of reducing silver to the metallic state.
4. Describe the process for obtaining pure silver.
  - a. Describe the process for obtaining pure silver from coin.
5. Describe the properties of silver.

6. What is the fusing point of silver?
7. What is the specific gravity of silver?
8. What is the process for obtaining granulated silver?
9. Describe the effects of sulphuric and of nitric acids on silver.
10. What occasions the tarnishing of a surface of polished silver?
11. Give the standard fineness of United States, English, and French silver coinage?
12. With what metal is silver usually alloyed to give it hardness?
13. What are the effects of copper upon silver in an alloy?
14. What alloy of silver and copper will give a durable plate for dentures?
15. Describe the process for manufacturing a silver plate for the mouth.
  - a. Give the fineness necessary for such a plate?
16. Give a formula for a fine silver solder?
  - a. Give a formula for an easy flowing silver solder?
  - b. Can a finer solder be used on a plate composed of silver and platinum, than on one of coin silver?
  - c. Give the process for making silver solders?
17. How may silver be deposited upon the surface of another metal? describe the process?

#### PLATINUM.

1. Give the symbol and atomic weight of platinum?
2. Describe the source and process for obtaining platinum from the ore?

3. In what form is it found in nature, and with what other metals is it more or less alloyed?
4. Describe the properties of platinum?
5. In what respect does it differ from gold and silver in its welding property, and what metal does it resemble in this property?
6. What is the weight of platinum compared with that of other metals?
  - a. What is its specific gravity?
  - b. What is its fusing point?
7. How is platinum melted; describe the process?
8. What will precipitate platinum in solution?
9. What is the best heat for welding platinum?
10. What remarkable property does platinum possess in regard to oxygen and other gases?
11. What is the proper solvent of platinum?
12. What degree of malleability has pure platinum?
13. What two metals only exceed it in tenacity?
14. Will any single acid affect platinum?
15. Has it the power of pure gold in resisting oxidation?
16. Do fusible metals readily alloy with platinum? but what is the effect of their oxides upon it.
17. Does it expand less under heat than other metals?
  - a. What is the most valuable use to which platinum is put in dentistry on account of its little expansion?
18. What is spongy platinum? what is platinum black? and what may they be used for in the making of porcelain teeth?
19. Have the alkaline carbonates any effect upon platinum? what effect has caustic potash?

20. What is the proper solder for platinum?
21. What kind of an alloy do equal weights of platinum and gold give?
22. What effect does the admixture of platinum with gold have upon the latter?
23. Do platinum and mercury amalgamate readily?
24. May silver and platinum be combined in all proportions? and what kind of an alloy is produced by these two metals?
25. What is the effect of iridium upon platinum?
26. What is the most useful salt of platinum?
27. Platinum unites with oxygen to form what two compounds?
28. What effect upon iron and steel has the 1000th part of platinum?
29. An alloy of 1 part platinum and 11 parts gold possesses what property rendering it useful in regulating teeth?
30. Will nitric acid act upon an alloy of platinum and silver?
31. What is the rank of silver as a conductor of heat? of electricity?

#### TIN.

1. What is the symbol and atomic weight of tin?
2. Describe the source, and form in which it is found, and the process of reducing tin to the metallic state.
3. Describe the properties of tin.
4. What effect has air upon tin, and under what circumstances does it oxidize freely, and what is the product of its oxidation?

5. What is the hardness of tin compared with that of lead?
6. What is the cause of the crackling sound emitted on bending a bar of block tin?
7. What is the action of nitric, and also nitro-hydrochloric acids upon tin?
8. What may cause tin to oxidize freely?
9. What is the fusing point and specific gravity of tin?
10. What effect upon the fusibility of tin does the admixture of lead and bismuth have?
  - a. Give a formula for a fusible metal composed of tin, bismuth and lead, which fuses at 250° F.
11. What is the effect of alloying gold and other metals with tin?
12. Is there any affinity between platinum and tin?
13. How may perfectly pure tin be obtained?
14. What common compounds does tin alloyed with lead form?
15. What is Reese's alloy for a base composed of?
16. What effect upon the fusibility of platinum has tin?
17. What is the object of using tin and gold combined in the form of foil in filling teeth?
18. Does mixing copper with tin afford useful alloys?
19. What is the formula of Babbitt metal most useful in the dental laboratory, and what advantage is it considered to possess over zinc?
20. What form of tin is used for filling teeth?

21. What is the rank of tin as a conductor of heat? of electricity?
22. Give three mineral acids which will dissolve tin and form stannic sulphate, stannic chloride and stannic oxide.
23. What two compounds of tin are employed in the preparation of purple of Cassius?
24. How is tin detected in a compound and in a solution?
25. What is Mosaic gold composed of?
26. What are the impurities of commercial tin?
27. How many per cent. of tin can be added to gold without destroying the malleability of the latter?

#### LEAD.

1. Give the symbol and atomic weight of lead.
2. Describe the source, form in which found, and process of reduction to a metallic state.
3. Describe the properties of lead.
4. Give its fusing point and specific gravity.
  - a. It volatilizes at what heat?
5. What is the effect of dilute nitric acid on lead?
  - a. What are the effects of other dilute acids?
6. Do lead and platinum possess much affinity for each other?
7. Does lead unite with tin in all proportions?
8. If bismuth is added to an alloy of tin and lead, how low may the fusing point be reduced?
9. What is the density of lead compared with that of other metals?
10. Does lead amalgamate readily with mercury?
  - a. What condition accompanies such a union?

11. What is the effect when a considerable amount of silver is added to lead?
12. How will the smallest amount of lead affect gold?
13. How may lead be removed from gold scrap?
14. What is the effect of lead when added to platinum?
  - a. When added to palladium?
15. What are the most valuable alloys of lead?
16. Give the formula of a fusible metal of lead, tin and bismuth which fuses at 200° F.
17. What is the composition of type metal, and its use in the dental laboratory?
18. What is the composition of Woods' metal and its dental use?
19. What is the rank of lead as a conductor of heat and electricity?

#### ZINC.

1. Give the symbol and the atomic weight of zinc.
2. Describe the source, and process of reduction to a metallic state.
3. Is metallic zinc ever met with in nature?
4. Describe the properties of zinc.
5. Give the fusing point and the specific gravity of zinc.
6. At what heat does it volatilize, and when heated in the air what occurs?
7. At what temperature does zinc become so brittle that it may be rubbed into a powder?
8. Do metals expand uniformly?
  - a. What is the degree of expansion of zinc, and what occurs during its cooling?

9. What may compensate for the expansion of a zinc die?
10. What rank does zinc occupy as regards ductility?
  - a. What rank as to malleability?
11. What is the object of adding zinc to an amalgam for filling teeth?
12. Describe the preparation of chloride of zinc.
13. What two filling materials are prepared from zinc?
14. Describe their preparation.
15. With mercury, what kind of an amalgam does zinc form?
16. What form of alloy results from adding zinc to silver?
17. What effect does zinc have upon the malleability of gold?
  - a. What effect upon the color of gold?
18. Can zinc and platinum, or zinc and palladium be combined at a low temperature?
19. Do zinc and lead freely mix?
20. If by accident lead becomes mixed with zinc what will the greater specific gravity of the lead cause it to do? and what is the effect on a zinc die so made?
21. Do zinc and tin easily unite in all proportions?
  - a. What is the value of a die made of zinc and tin?
  - b. What should be the proportions of such a die?
  - c. Are counter-dies ever made of zinc as well as the die?

- a. What quality of plate may require such a die, and counter-die? also what form of set?
- 22. What alloy do zinc and copper form?
  - a. What is German silver?
- 23. What effect may zinc have upon the cast-iron ladle in which it is melted?
  - a. How may such accidents be avoided?
- 24. What distinguishes the presence of zinc in solution?

#### BISMUTH.

- 1. Give the symbol and the atomic weight of bismuth?
- 2. Describe the source, and the process of reducing and purifying bismuth?
- 3. Describe the properties of bismuth.
- 4. Give the fusing point, and the specific gravity?
- 5. What degree of tenacity has bismuth?
- 6. What are the impurities found in bismuth?
- 7. Does it readily unite with tin, lead, silver, mercury, etc.
- 8. What effect has bismuth upon the fusibility of metals?
- 9. What salt of bismuth is of importance as a medicinal agent?
- 10. Give some formulae for fusible alloys of bismuth and other metals useful in the dental laboratory?

#### ANTIMONY.

- 1. Give the symbol, and the atomic weight of antimony?

2. Describe the source, and process of reduction to a metallic state; also the varieties of antimony?
3. With what minerals is it generally associated?
4. Describe the properties of metallic antimony?
5. What is its degree of brittleness?
6. Give the fusing point, and the specific gravity of antimony?
7. What peculiarity is there about the vapor of antimony?
8. Why is its reduction from the ore attended with great loss?
9. Is it volatile enough to pass over by distillation?
10. Is it oxidized by air at common temperatures?
11. What are the three compounds of antimony and oxygen?
12. What are the solvents of antimony?
13. What is its effect upon other metals?
  - a. What is its effect particularly on gold?
14. Of what common alloys does it form a part?
15. What medicinal agents are prepared from it?
16. What peculiar structure has metallic antimony?

### MERCURY.

1. Give the symbol and the atomic weight of mercury?
2. Describe the source, and the form in which it is found, and the process of reduction of mercury?
3. By what process is mercury purified?
4. With what metals may it be adulterated?
  - a. How may such impurities be detected?
5. Describe the process of freeing mercury from impurities by means of mercurous nitrate? also by means of fine ground loaf sugar?

6. Describe the properties of mercury ?
7. What will deprive mercury of its metallic lustre ?
8. With what metals does mercury readily amalgamate ?
  - a. Name the metals with which it does not readily amalgamate ?
  - b. With what metal does mercury combine with violence and the development of light and heat ?
9. What is the fusing point of mercury ? and its specific gravity ?
10. Below what degree may mercury be hammered and welded ?
11. At what degree does mercury volatilize ?
  - a. Does it volatilize somewhat at ordinary temperatures ?
12. What acid diluted with 2 parts of water will remove lead from mercury by oxidation after several days action ?
13. What action has hydrochlorine acid on mercury ?
  - a. What action has concentrated and heated sulphuric acid, and into what does it convert the mercury ?
14. Mercury unites with oxygen to form what oxides of a poisonous character ?
  - a. What two compounds does it form with chlorine ?
  - b. Name the medicinal forms of mercury ?
  - c. It combines with sulphur to form what ?
  - d. What mercuric sulphide is used as a coloring matter for rubber and celluloid ?
15. Describe the process of preparing vermillion ?

16. What is vermillion often adulterated with?
17. Describe the properties of vermillion?
18. Is it an inert mercurial compound when pure?
19. What effect does water, or nitric, or sulphuric, or hydrochloric acid have upon vermillion?
20. Is pure vermillion in combination with vulcanizable dental rubber or celluloid capable of producing deleterious effects when worn in the mouth?
21. What temperature will decompose vermillion, and what does the condensed vapor yield?
22. If free mercury is ever found in rubber, to what may its presence be ascribed?
23. To what may the inflamed condition of the oral mucous membrane in contact with a rubber plate which is sometimes seen, be ascribed?
24. Describe Reinsch's test for detecting the presence of the soluble salts of mercury.
25. Describe the process of incorporating the mercury with the other metals forming an amalgam for filling teeth.
  - a. How is the excess of mercury gotten rid of?
  - b. What is the effect of cadmium on tooth structures when this metal forms one of the component parts of an amalgam?

### PALLADIUM.

1. Give the symbol and atomic weight of palladium?
2. Describe its source, and the process of reducing it to a metallic state?
3. Describe the properties of palladium.
4. To what other metals is it similar as to properties?

5. Give the fusing point, and specific gravity of palladium?
6. What metal does it resemble in color, hardness, and capability of being welded when in a spongy mass?
7. Is there chemical affinity between palladium and mercury?
8. Does palladium oxidize more readily than platinum?
  - a. At what temperature does it oxidize?
9. What is its best solvent?
10. What effect has nitric acid upon palladium?
11. When large masses of palladium and mercury are amalgamated what results?
12. What is the effect of an amalgam of palladium on tooth structures?
13. Does palladium unite with silver in all proportions?
14. What is the effect of iodine upon palladium? and how may iodine be employed to distinguish palladium from platinum?
15. What kind of an alloy does gold and palladium form?
16. Can palladium be advantageously employed to harden plates of gold and of platinum?
17. What is the principal test for palladium?

### IRIDIUM.

1. Give the symbol, and atomic weight of iridium?
2. Describe the source, and process of obtaining iridium?
3. Describe the properties of iridium?

- a. What is its most interesting form ?
- b. With what metal is it generally associated ?
- 4. At what temperature is iridium insoluble in all acids ?
  - a. What is necessary to again dissolve it ?
  - 5. On account of its great hardness and high fusing point for what is it used in the arts ?
  - 6. Give the fusing point and specific gravity of iridium ?
  - 7. At what temperature may it be compressed into a compact mass ?
  - 8. What is its solvent when reduced by hydrogen at low temperature ?
  - 9. What is the effect of adding small quantity of iridium to platinum ?
  - 10. How may iridium be employed to strengthen the backings of a continuous gum set ?
  - 11. What kind of dies and counter-dies are necessary to swage iridium ?
  - 12. What kind of solder must be used with iridium ?
  - 13. What does iridium form with oxygen, iodine, sulphur and chlorine ?
  - 14. What is the effect of iridium upon the working properties of gold ?
    - a. What gold often contains minute grains of iridium ?

### ALUMINIUM.

- 1. Give the symbol and the atomic weight of aluminium.
- 2. It is the main constituent of what oxide or earth ?

3. Describe the source and the process by which it is obtained.
4. What do all clays consist of?
5. Describe the properties of aluminium?
6. What other metal does it closely resemble in color?
7. What is its most striking property?
8. Give the fusing point and specific gravity of aluminium.
9. How many times heavier than water is it?
  - a. How many lighter than silver?
  - b. How is its bulk compared with that of silver?
  - c. If one ounce of silver will make a plate, how many plates will one ounce of aluminium make?
10. What is the proper solvent of aluminium?
11. What effect has air upon aluminium?
  - a. What effect has sulphur compounds? strong nitric acid? dilute sulphuric acid?
  - b. Will dilute or strong hydrochloric acid readily dissolve it?
  - c. Will solutions of caustic potash or soda?
12. To what extent does it possess ductile and malleable properties?
  - a. What is its tenacity compared with silver and copper?
13. Does aluminium unite with mercury?
  - a. Does it unite with lead?
14. Its most striking alloys are with what metal?
15. How does it alloy with zinc?
  - a. How with iron?

- b. What is the nature of its alloys with silver, with copper, with tin, with zinc?
- 16. Can a cast plate for a denture be made of it?
  - a. Are swaged plates of it easier made?
- 17. What are the objections to aluminium plates for dentures?
- 18. What is the best solder for aluminium?
- 19. What is the effect of a flux; can any flux be used in soldering aluminium?
- 20. Does disintegration progress with greater rapidity in a cast plate than in a swaged plate of aluminium?

## CADMIUM.

1. Give the symbol and atomic weight of cadmium.
2. Describe the source, and process of reducing cadmium to the metallic state, and also its properties.
3. What mineral contains cadmium in quantity?
  - a. What mineral contains it in small quantity?
4. To what metal is cadmium closely allied?
  - a. How does it differ from zinc in its crystalline form?
5. How does cadmium compare in hardness with tin and zinc?
  - a. How does it compare with zinc as a conductor of electricity?
6. What is its value as a component part of an amalgam for filling teeth?
7. What effect is it considered to have upon tooth tissue?
  - a. What effect has it upon the color of an amalgam when it is combined with silver and tin?

8. Give the fusing point and specific gravity of cadmium.
9. What is the best test for cadmium ?
10. What will separate it from its solution as carbonate ?
  - a. What from its solution in acids ?

### COPPER.

1. Give the symbol and the atomic weight of copper.
2. Describe the source and process of reducing copper to the metallic state.
3. Of the several ores which yield copper, from which is it usually obtained ?
4. Describe the properties of copper.
5. Describe the process of obtaining pure copper.
6. Why is copper so generally valuable in the arts ?
7. Give its fusing point and specific gravity ?
8. How does it rank as a conductor of heat and electricity ?
9. In tenacity how does copper compare with iron ?
10. What is the solvent effect of nitric, of sulphuric, of hydrochloric acid upon copper ?
11. Has copper much affinity for mercury, and what condition must it be in to amalgamate readily ?
12. Describe the properties and effects on tooth structure of an amalgam composed of copper and mercury alone.
13. Does copper unite readily with all other metals except mercury ?
14. Why is copper added to gold and silver coin ?

15. Why is the formation of a perfectly uniform alloy of copper and silver difficult?
16. What kind of an alloy do copper and platinum form when the proportions are equal?
17. What are the principal alloys in which copper forms the most important ingredient?
18. What is the effect of an admixture of lead and bismuth with copper?
19. Give the composition of brass? of German silver?
20. What property do small quantities of copper confer on amalgams?
21. What is afforded when as a test caustic potash is added to copper?
  - a. What in the case of hydrogen sulphide, or ammonium sulphide, or potassium ferrocyanide.
  - b. Describe the method of detecting copper in very weak solutions by means of platinum foil and zinc.
  - c. What does copper impart to the oxidizing flame of a blow pipe?
22. What is aluminium bronze? What is phosphor bronze?

### IRON.

1. Give the symbol and atomic weight of iron?
2. Describe the sources and the process of reducing iron to a metallic state.
3. Describe the properties of pure iron.
4. Give its fusing point and specific gravity?

- a. Is it difficult to melt, and just before becoming liquid what condition does it assume?
5. Describe its tenacity and ductility?
6. At a red heat what effect does iron have upon water, what gas is evolved, and what kind of an oxide is formed?
7. Does iron oxidize in dry air at ordinary temperatures?
  - a. What is the effect as regards oxidation on contact with a more electro-positive metal?
8. What converts iron into steel?
9. In what respects does steel differ from iron?
10. What is the chemical difference between cast-iron, wrought-iron and steel?
11. Describe the two processes by which steel may be produced?
  - a. What is cast steel? What is shear steel? and how do they compare in density and hardness?
12. How is Bessemer steel manufactured?
13. Name the best form of steel for dental instruments?
  - a. Describe the process of forging such instruments?
  - b. Describe the process of tempering excavators, pulp-instruments, and pluggers?
  - c. In tempering what are the colors of the steel owing to?
14. How may the quality of steel be determined?
  - a. If the fracture of a bar of steel presents a coarse, glittering appearance, what is the quality?

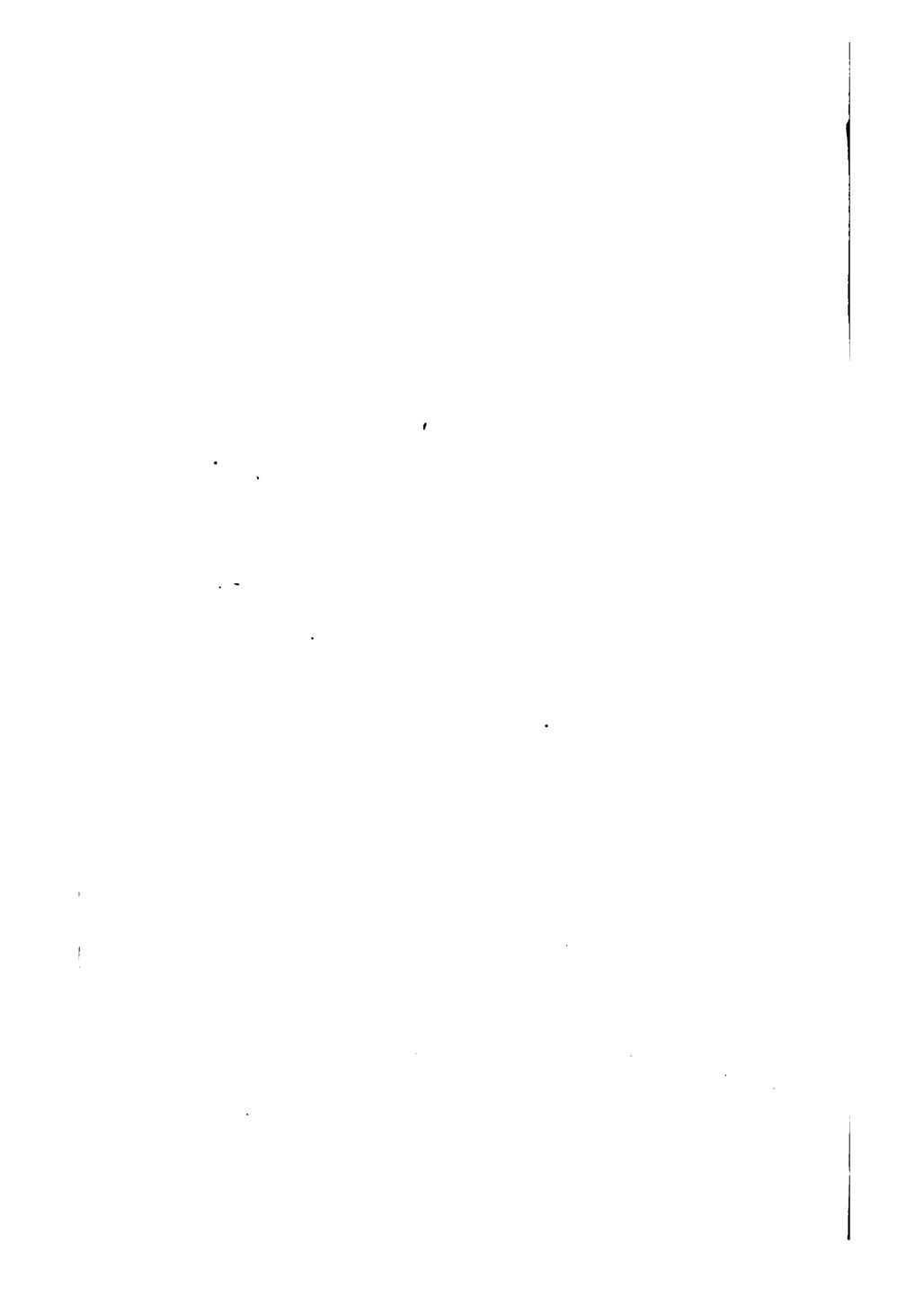
- b. If a fine, close grain, of a grayish-white color, and a uniform and almost silvery whiteness?
- c. How may the quality be tested with dilute nitric acid?
- d. What temperature does the finest steel require?
- e. What effect has hammering or forging on steel?
- f. How is blistered steel to be treated?
- g. Give the tempering heats and colors of enamel chisels, pluggers, excavators, pulp instruments, and especially where elasticity is required?
- h. What is case-hardening?

15. What is malleable iron and the process of producing it?

16. How can a steel instrument be distinguished from an iron one?

#### ELECTRO-METALLURGY.

- 1. What are the two branches of electro-metallurgy?
  - a. Describe the processes of electrotyping and electro-plating.
  - b. Describe the process of electro-gilding.
  - c. Describe the process of depositing iron on a metallic surface such as copper, and the object.
  - d. Describe nickel-plating and its advantages.
  - e. Describe a simple battery for electro-plating.



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